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# SMOKELESS AIR

JOURNAL OF THE
NATIONAL SOCIETY FOR CLEAN AIR




No. 115 ★ AUTUMN 1960 ★ 2/-

*In this Issue*

Smoke Control Area Programmes ★ The Sticks and Paper Circular ★ Mortality, Fog and Air Pollution ★ International Section ★ Heights of New Industrial Chimneys ★ The Society's Headquarters Fund

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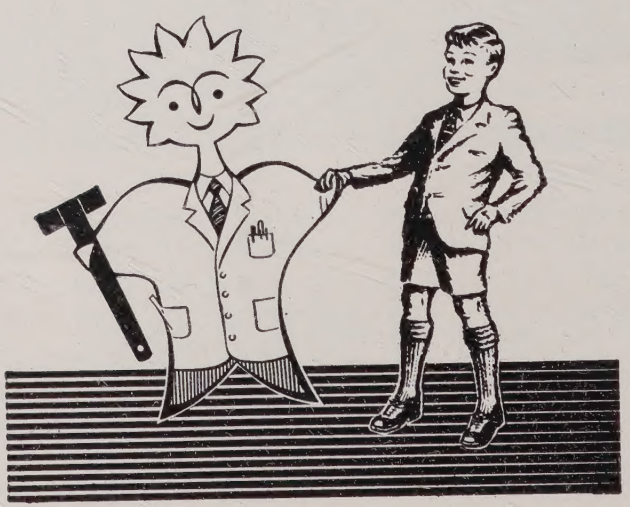
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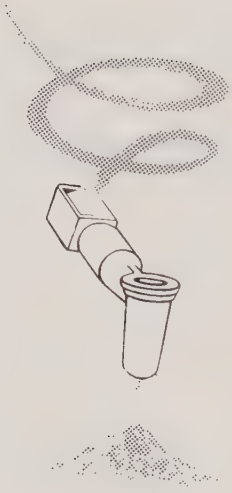
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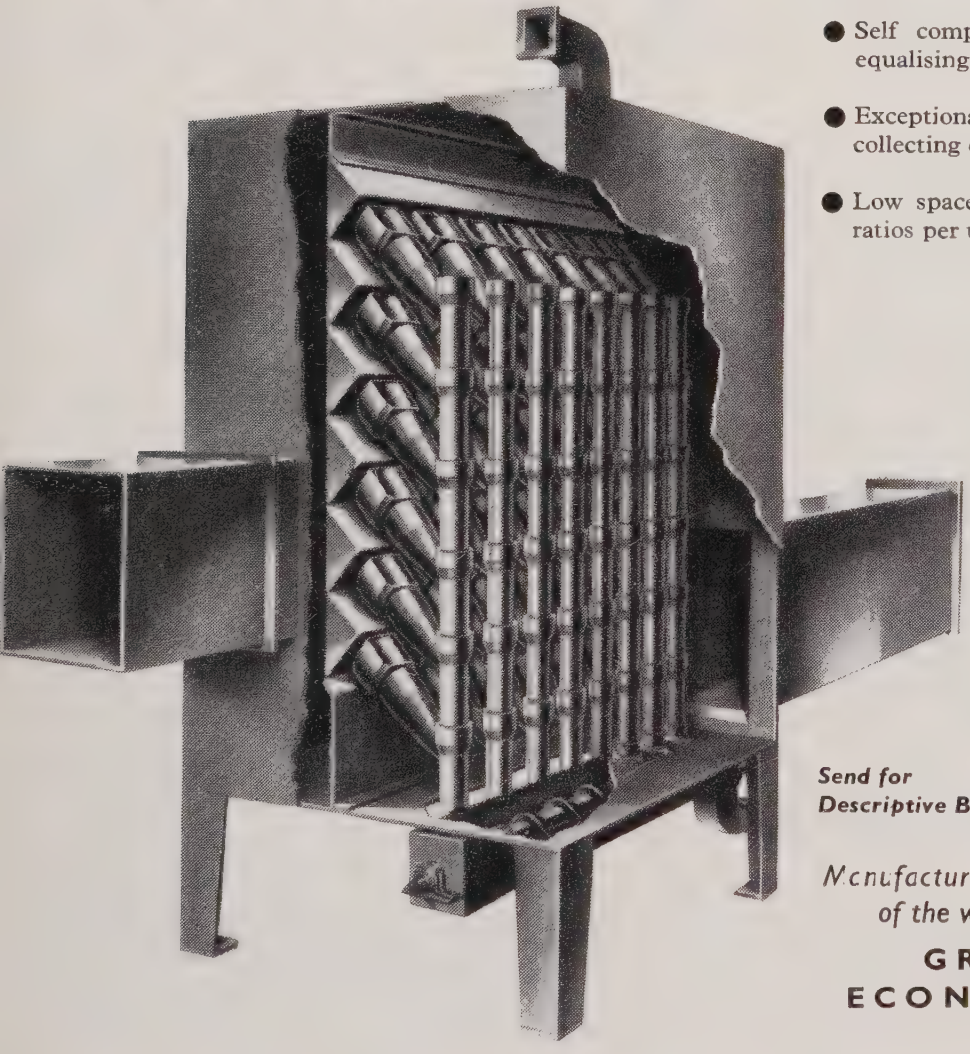
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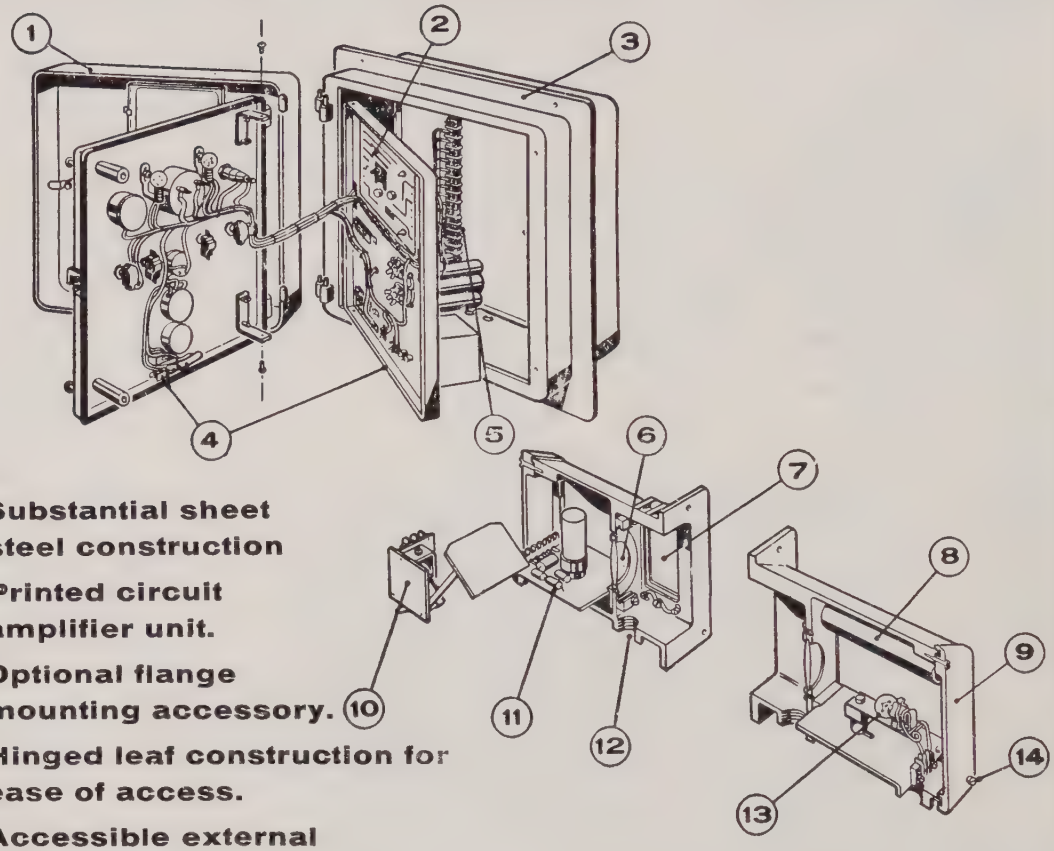
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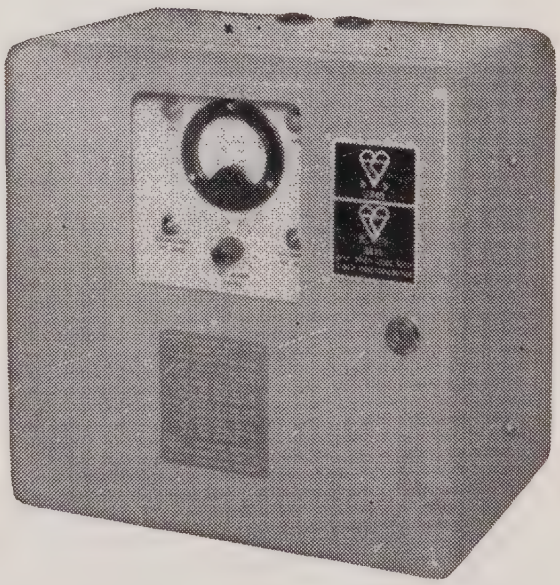
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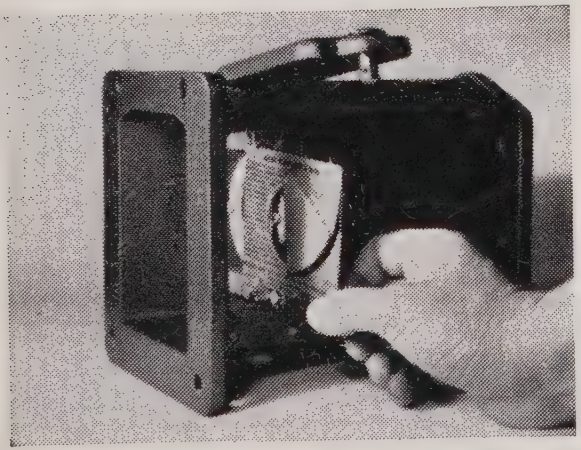
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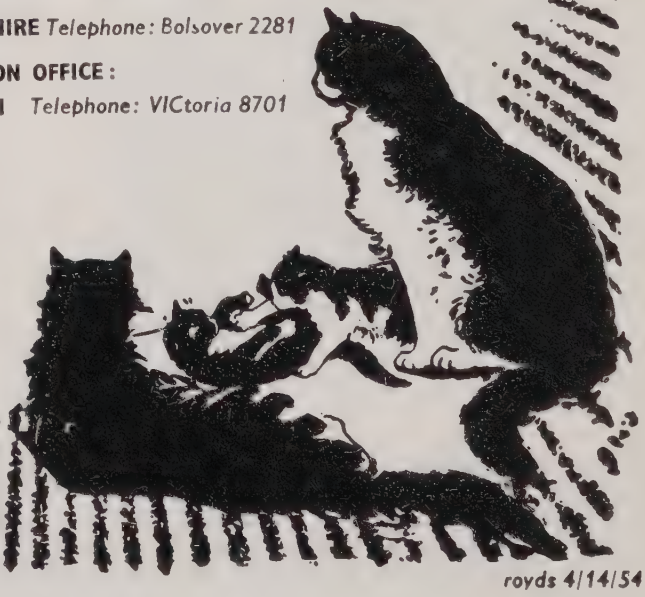
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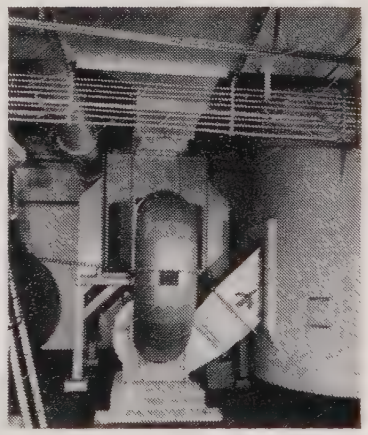
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*For further information and examples of the full range of free informative literature, apply to:*

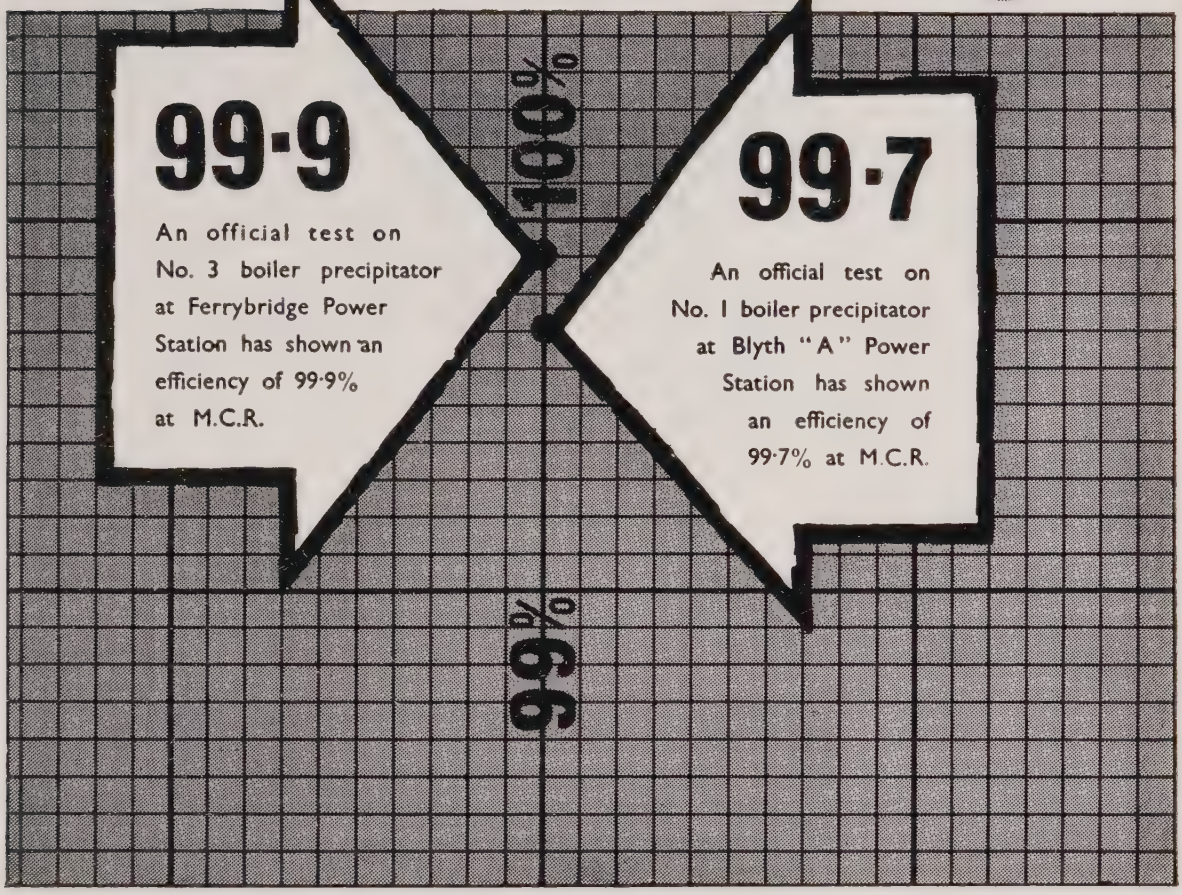
Under the Clean Air Act, powers are given to local authorities to arrange for Clean Air Exhibitions, etc., and to promote educational campaigns to get public support in abolishing smoke and air pollution. Services of this kind have been provided for local authorities by the S.S.F.F. since its formation in 1944. The Federation has either organised or participated in Clean Air campaigns up and down the country. The S.S.F.F. exhibition stand and two mobile exhibition units displaying the full range of solid smokeless fuels, and approved appliances actually burning the fuels, are prominent features of these campaigns.

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Please note that the Society is now at its new address:

**Field House, Breams Buildings,**
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Telephone:
**CHAncery 5038***

** Not as previously announced*

*Late News*

## PHOTOGRAPHIC COMPETITION

The Society and the *News Chronicle* are co-operating in a competition, open to all, for photographs of Air Pollution interest suitable for the Society's publicity work. £160 in prizes will be offered. Details will be sent on request to all readers who are interested.

*Publication in September is announced for*

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# SMOKELESS AIR

Vol. XXXI No. 115 Autumn 1960

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*Ships, towers, domes, theatres and temples lie*
*Open unto the fields, and to the sky;*
*All bright and glittering in the smokeless air.*

# SMOKELESS AIR

## The Smoke Control Areas Report

ON another page we have reviewed, and sought to indicate the principal conclusions that may be drawn from the report issued by the Minister of Housing on the programmes submitted by local authorities for the phased establishment of smoke control areas. The request was made only to those authorities in the black areas and the report shows that even there a large proportion of them were unable to produce a programme, even three years after the passing of the Clean Air Act. Detailed forecasts were asked for only up to 1963, but doubt on the reality of these figures, as well as upon the target date for the completion of the programmes, are created by the fact that the actual progress made during 1959 was only 60 per cent. of what had been estimated at the beginning of that year.

The whole purpose of the smokeless zone or smoke control area principle is to enable any town or conurbation to become smokeless by stages. It has been adopted for the sake of administrative and technical or production convenience, but the whole essence of the method is that the stages should follow each other at a reasonable rate. The ten to fifteen years suggested by the Beaver Committee in 1954 was sensible and by no means hasty, and if the necessary effort had been started then, or when the Act was passed, the black areas could have been made smokeless by 1970. But from these returns we find that only 45 authorities aim to finish by the end of 1969, and 26 give dates in the 1980's or beyond—not counting, of course, those which have not yet planned a programme and may, for all we know, not get down to one for another decade or two.

One of the unresolved difficulties that the report makes evident is the inhibiting effect that the problem of concessionary coal is having in the mining areas. It is continuing to be discussed at regional or district levels and no good would be done by crying out for some quick and seemingly easy solution. Patience and quiet persistence must go hand in hand if this skeleton in the clean air cupboard is to be removed.

The report comes very opportunely for the Society, as it adds to and supplements the information gained for our own inquiry into the working of the Clean Air Act, reports on which are to be presented and discussed at the Harrogate conference. We would urge, therefore, those who are to attend the conference to study the salient facts it discloses.

Although the report shows that many authorities are going ahead with smoke control in an admirably energetic way, it also shows that many—perhaps the majority—are dragging their feet, some very badly. It emphasizes once more the need for continuing and extending educational and propaganda work for clean air, in which the Society should and can take a leading part. It is obvious, too, that this must be directed not only to the public at large but in many cases to the local authorities themselves. We look like having plenty to do until 1990, at least.

## Home News

The heading is appropriate as we wish to remind readers that by the time this is published the Society will be installed in its new home at Field House, Breams Buildings, London, E.C.4. On another page we give a first list of acknowledgments for the donations received to the Headquarters Fund. As is pointed out, the appeal was launched at a time that meant delay, because of the summer recess, in its consideration by many local authorities, who are therefore not represented in this first list to the extent we are sure will be the case in later lists. Taking this delay into account, the response to the appeal is most gratifying and our appreciation is extended to all who have contributed, or will do so.

Little needs to be said at the moment about the Harrogate conference, except that (apart from the exceptional International Conference last year) the number of registrations had, by the beginning of August, exceeded the final total for any previous conference, and that the bookings for the exhibition have exceeded our most optimistic expectations.

## Sticks and Paper

Much comment, suggesting surprise or amusement, was made in the Press on the recent " Sticks and Paper " circular, even to the extent of leaders in both *Times* and *Guardian*. The circular, from the Ministry of Housing and Local Government, is addressed to local authorities and is to the effect that in premises in smoke control where there is no town gas available or where it cannot be supplied at reasonable cost, sticks and paper should be permitted for the lighting of authorized solid fuel fires. The circular is reported in detail on another page. There is no doubt something amusing about a serious Government pronouncement on such a chore, although all concerned with the Clean Air Act are well aware that it is an important and awkward point, involving to many a matter of principle. In this nuclear, electronic and automated age there does seem something odd about a regulation on so ancient and crude a practice. (The sticks involved are of course to ignite the fuel, not for twirling to ignite the paper). We wish that it had been quite unnecessary.

Some local authorities have taken the attitude that is stated in the circular: " In the Minister's view the small amount of smoke caused in this way must be accepted in the general interest of making progress with the creation of smoke control areas." Other authorities have hitherto taken a different view, considering that to permit such a concession would be to open the doors too wide for abuses and demands for further concessions. For instance, if sticks and paper are allowed it may lead to further assistance being given to the fire-lighting operation by coal, oily waste, and so on. Only a firm adherence to the principles of smoke control could prevent their gradual erosion.

Where it is definitely impracticable and uneconomic to install gas—perhaps for use solely for fire-lighting—the Minister's view seems to be the obvious one, provided that the qualifications he makes are noted by the authorities and are observed with care. There is still one area of doubt—cases where although gas is not supplied it is not too far away, and could be brought in at a cost that may be reasonable or unreasonable according to the way this word is interpreted both by the authority and the Ministry.

## Mr. Robens

Readers who attended the Bournemouth conference of the Society in 1955 will remember the lively " Brains Trust " session on the Clean Air Bill, with Mr. Alfred Robens and Mr. Gerald Nabarro on the platform to answer the many questions that were fired at them as Members of Parliament concerned with the Bill. They will remember that Mr. Robens made

very clear his keenness for clean air as well as his understanding of the nation's fuel problems and policies. They will, we are quite sure, be glad to join with us in extending to Mr. Robens our best wishes on his appointment as Chairman of the National Coal Board—one of the most responsible and difficult jobs in the country. The N.C.B. is now doing a great deal to assist the clean air movement through the work it is doing on the development of new processes for smokeless fuel production, and we hope that with Mr. Robens at the helm this work will be further accelerated and developed. We think it may be, and if we may quote:

". . . Let us say to the N.C.B. that whilst we appreciate all the efforts they are making—and they have been very great efforts to produce a smokeless fuel from the coal that they mine—this must be done at a greater pace."

We commend this appeal to the new Chairman. It was said by Mr. Robens at Bournemouth.

## Coke and Coal

The annual report, for the year ended June 30th, 1960, of the Domestic Coal Consumers' Council (published with the report of the Industrial Council, H.M.S.O., 1s. net.) has several references of importance to the clean air campaign. First, the Council welcomes the new British Standards Specification for coke, and hopes that it will not be long before all open grate coke is made to this specification. Secondly, there is a paragraph about the problem of moisture in coke, on which so many complaints are made and so many letters to editors are written. Though recognizing the difficulties of keeping it dry in all circumstances, the Committee think " it is grossly unfair to expect consumers to pay for this excessive moisture as if it were coke," and believe that " reputable traders are prepared to deal fairly with justifiable complaints on this score, and we look to them, in their own interests, to see that they are not let down by other members of the trade." It is recommended that more thought be given to finding some practicable means of moving and storing coke under cover.

Thirdly, the report has some strong words about the practice of selling house coal of a lower grade at the price of a higher grade. The Committee has made inquiries and conclude that some traders were taking advantage of the domestic consumer, and that " sharp practices on the part of a minority of traders can do a great deal of harm to the good name of house coal." The recommendation is made to the Minister of Power that all traders should be required to state the N.C.B. grouping of the coal they sell and that any misrepresentation of the group should come within the scope of the Merchandise Marks Acts.

This is of importance to clean air progress, and we hope it will be done. The reason is that if coal has to be sold at the correct margin of profit it will be just as advantageous to sell smokeless fuel at a similar margin. The smokeless fuels cannot be sold as other than what they are, and although this concerns only the minority of traders to which the Committee refers, it may well be one of the reasons for the opposition to smoke control that is so often found in the trade.

## Guess Who

We have been intrigued by the appearance in the North West of an organization peculiarly known as the " Council for Realism in Smoke Control." Its main function appears to be to oppose proposals for smoke control areas and (according to a letter in a local paper) to teach this Society " to see beyond the end of its nose." We have not been able to discover who supports and inspires this body, but not being entirely without realism ourselves we think we might be able to guess.

# THE STICKS AND PAPER CIRCULAR

This Circular of the Ministry of Housing and Local Government (No. 28/60) is discussed in our editorial columns, and below we quote from the letter itself. After stating that the Minister has had a number of inquiries about the use of sticks and paper for lighting fires in smoke control areas, and that local authorities may find it useful to have some guidance, it is said:

" 2. There is little doubt that coke can best be ignited by gas, and that gas provides the most convenient smokeless method of lighting other smokeless solid fuels. Nothing in this circular therefore is intended to discourage the use of gas for fire lighting in smoke control areas.

" 3. There will however be houses which have no town gas and cannot be supplied with it at a reasonable cost. Some people, too, may object to having gas in their houses at all, and in the Minister's view it would be unreasonable to insist that they should.

" 4. It is probable that, in time, other means for lighting fires smokelessly will come into general use. There are already on the market devices which make use of bottled gas. But for the foreseeable future it is likely that sticks and paper will commonly be used for lighting fires where there is no supply of town gas. In the Minister's view the small amount of smoke caused in this way must be accepted in the general interest of making progress with the creation of smoke control areas.

" 5. The Minister thinks that legal cover for the use of sticks and paper for lighting fires can best be given by the use in smoke control orders of the power of exemption in section 11(3) of the Clean Air Act, 1956. Local Authorities could give an exemption in general terms extending to fireplaces in any building or separately occupied parts of a building which is not supplied with town gas; or alternatively, they could give a specific exemption to named individual premises. Either type of exemption should be subject to a condition to secure that it would have effect only where authorized fuels or kindling sticks and paper were being used.

" 6. The Minister therefore asks local authorities, in preparing smoke control orders for any area where it is apparent that some buildings or separately occupied parts of buildings will remain without a gas supply, to include provision for exempting them."

Then follows a model for a general exemption, as follows: *Class of fireplace to be exempted:* Fireplaces in buildings, or parts of buildings separately occupied, without gas supply. *Conditions:* Only authorized fuels, as declared by regulations under the Clean Air Act, 1956, and kindling sticks and paper shall be used in the fireplaces. For individual exemptions the conditions would be the same, and the fireplaces to be exempted would be specified.

The circular continues: " If for any reason a local authority should decide not to include provision on these lines in any smoke control order for an area in which there are premises without a gas supply, it is requested that they should give an explanation of the special circumstances when submitting the order for confirmation."

**Model Questions and Answers**

The circular also contains a note on, and includes as an appendix, a document entitled " Smoke Control Areas: Your Questions Answered." This is not being made available for distribution direct to the public but is published as a guide for local authorities who may wish to produce explanatory booklets, possibly with additional matter, for householders in proposed smoke control areas. There is also a note on the Women's Advisory Council on Solid Fuel,

(*concluded on page* 22)

# SMOKE CONTROL AREA PROGRAMMES

## *White Paper's Disclosures*

THE Minister of Housing and Local Government has presented to Parliament, as a White Paper (Cmd. 1113, price 3s. net) a summary of the programmes submitted to him by local authorities for the establishment of smoke control areas.

The information was obtained from the replies received by the Minister to a circular issued in January, 1959, in which he " asked that local authorities in black areas should consider their domestic smoke problem as a whole; that they should decide on the smoke control areas that were needed, in what order of priority they should be made, and how many years it was likely to take to finish the job: and that they should prepare a phased programme for establishing smoke control areas over the next five years." It is pointed out that although the Minister recognized that there might be other areas where a systematic approach to more localized domestic smoke problems might be needed, he did not ask for programmes from these areas.

The introduction to the report points out that there is no accepted definition of what are the black areas, but refers to the Ministry's own suggestion that 324 local authorities in England and Wales might be regarded as black areas in whole or in part. Out of the 294 of these authorities in England, 85 had not submitted programmes as requested by the Minister (by March 31st, 1960), while in Wales a programme had been submitted by only one authority —Newport—out of the 30 in the principality.

The reasons for this lack of response from Wales are given: some authorities still had the question under consideration, but most took the view that their districts were not in black areas. " This response to the circular probably reflects the relative smokelessness of much of the house coal used in Wales and Monmouthshire."

Apart from the introduction the report consists entirely of tables summarizing the returns. The tables, divided regionally, give (*a*) the number of premises, (*b*) the number of dwellings, and (*c*) the acreages in smoke control areas or smokeless zones, under the following heads: covered by Orders to the end of 1958; estimated additions in 1959, 1960, 1961, 1962 and 1963; estimated position at the end of 1963; final objective (total numbers intended finally to be covered), and finally the target year for completion.

Taking the number of premises as the key figure, we find that the totals for the programmes, for the whole of the black areas, are as follows:

| | |
|---|---|
| End of 1958 .. .. .. | 120,450 |
| „ „ 1959 .. .. .. | 246,086 |
| „ „ 1960 .. .. .. | 470,625 |
| „ „ 1961 .. .. .. | 477,718 |
| „ „ 1962 .. .. .. | 447,277 |
| „ „ 1963 .. .. .. | 486,159 |
| Estimated position, 1963 .. | 2,250,306 |
| Final objective .. .. | 5,940,770 |

The grand total for the final objective is made up, regionally, as follows:

| | |
|---|---|
| Northern .. .. .. | 270,938 |
| East and West Riding .. | 890,915 |
| North Midland .. .. | 291,009 |
| Greater London .. .. | 2,097,870 |
| North Western .. .. | 1,415,461 |
| Midland .. .. .. | 792,403 |
| South Western .. .. | 149,000 |
| Wales and Monmouthshire .. | 33,174 |

A disappointing feature emerges from a final table, which it is salutary for the Ministry to have included. This compares the programmes for

1959 (as included in these programmes) with the real progress made in that year—that is, the Orders actually made. For the total number of premises this table shows that whereas the additions for 1959 were forecast as 246,086, the actual additions were only 147,822. It may be that much of this shortfall was due to temporary delays, but if it is due to more permanent failings then the prospects for the coming years are less favourable than they appear.

It is not easy to summarize, in a fair manner, the differences that are revealed in the regional summaries, but what does stand out very clearly is the relative lack of response in the mining areas—including towns that are not primarily mining towns. 30 of the 85 authorities which had not responded to the Minister's request indicated that they were concerned about the effect of smoke control on those entitled to receive concessionary coal. Apart from this, however, there are considerable differences, region by region.

The regions that come out best are the County of London, with all but two of the 28 metropolitan boroughs—or 92 per cent.—submitting programmes; followed by South Lancashire and North-east Cheshire with about 86 per cent.; and then Merseyside and the West Midlands with 80 per cent. After that comes the West Riding (North) with 70 per cent.

In contrast, only a half of the authorities in the Tyneside-Wearside region have submitted programmes; three out of eight in Teeside, 50 per cent. for Central Lancashire, 38 per cent. for the East Midlands, 32 per cent. for Outer London, and the one in thirty already mentioned for Wales.

A list of authorities that have prepared programmes would be too lengthy for this review, as would a complete list of those which have not. But since the Boroughs, county and municipal, are presumably the larger and more important authorities it may be appropriate to name those who have not submitted a programme, grouped according to their region:

South Shields, Tynemouth, Wallsend; Darlington, West Hartlepool, Hartlepool, Stockton-on-Tees, Thornaby-on-Tees; Castleford, Pontefract, Pudsey; Barnsley; Ilkeston; Poplar, Southwark; Beckenham, Epsom and Ewell, Erith, Harrow, Ilford, Mitcham, Romford, Surbiton, Sutton and Cheam, Twickenham; Dukinfield; Accrington, Colne, Nelson; Bilston, Rowley Regis; Cardiff, Merthyr Tydfil, Swansea, Llanelly, Neath, Port Talbot, Rhondda.

*Final Target Dates*

The dates given by the authorities for the completion of their programmes vary considerably. Most are in the 1970s, but 45 give dates in the present decade—half of which are in the Greater London area. The earliest date of all for completion is 1962 for Newport, followed by 1964 for Stoke Newington, St. Marylebone, Barking, Middleton, Mossley, Little Lever, and Huyton-with-Roby.

At the other end of the time scale we find Derby, which gives between 1990 and 2000! Solihull, Blackburn and Sunderland give 1989, Warrington and Newcastle-under-Lyme 1985; Smethwick and Leyton 1983, and Bebington 1982.

Other late finishers, at or up to 1980 are: Huddersfield, Leeds, Wakefield, Elland, Mansfield, Long Eaton, Islington, Lambeth, Wandsworth, Bexley, Bromley, Wimbledon, Crayford, Friern Barnet, Merton and Morden, Oldham, Wolverhampton and Stoke-on-Trent.

The report is also commented upon in our editorial notes, on an earlier page.

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**Sticks and Paper**—(*concluded*)

which is prepared to train groups of members from voluntary organizations undertaking home visiting who are willing to advise on the correct use of smokeless fuels. It is also pointed out that the Solid Smokeless Fuels Federation is willing to arrange exhibitions in smoke control areas.

# SMOKE CONTROL IS POPULAR

*Evidence published by Society of Coal Merchants*

Effects of smoke-control areas in certain districts of London on the heating and fuel habits of the people who live in them are the subject of a survey recently carried out by Consumer Research, Limited, on behalf of the Society of Coal Merchants. The districts covered—Fulham, Hackney, Hayes and Harlington, Lewisham, Wood Green, and Woolwich—where 509 housewives were interviewed, give a representative picture of changed habits.

A report on this survey was published in *The Coal Merchant and Shipper* for July 30th, from which, with acknowledgments, we quote:

The conclusions show that most housewives are in favour of smoke-control zones, considering them to be more healthy and cleaner than previously. Even most of those who do not like or are indifferent to the present zones only disagree with certain aspects, such as proximity to factories not in the zone, which would be remedied if the area of the zone were increased.

The survey reveals an overall decrease of one-sixth in the number of housewives using solid-fuel appliances (excluding boilers), the cause being a marked decrease in the use of open fires, which has not been matched by a corresponding increase in all-night fires. A " considerable increase " in the use of electric fires and oil burners is noted, with a relatively small increase in gas fires.

The use of coal has virtually ceased and has been replaced mainly by smokeless fuels suitable for unimproved and improved open grates, *i.e.*, " Coalite " large, " Rexco " large, " Cleanglow," " Phimax," and " Warmco." Increased use of fuels suitable for improved grates (gas and hard coke, and " Gloco ") is small, as is also that of fuels for closed stoves (" Phurnacite," anthracite, dry steam coal, cooker " Coalite," and " Rexco " nuts).

Storage problems do not appear to have worried housewives. About one-fifth considered their present storage inadequate, but few were able to say whether it had been adequate before. Few of the housewives interviewed had any difficulty in lighting fires using smokeless fuels, gas or sticks and paper proving satisfactory.

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## BIOLOGICAL ASPECTS OF POLLUTION

**The Effects of Pollution on Living Material. Symposia of the Institute of Biology, No. 8. Published by the Institute. pp. 154. 25s. net.**

This volume is the record of the proceedings of the symposium of the Institute of Biology held in London in September, 1958. It contains the fourteen papers presented at the meeting, with the discussions upon them.

The papers deal with the problems of pollution in rivers and estuaries, and aspects of air pollution in relation to their biological effects. Radioactive pollution is included, and also a paper on the disposal of radioactive wastes.

The general air pollution papers were as follows: " Air Pollution—Some Chemical and Physical Aspects of its Effects on Living Material," by Dr. E. T. Wilkins; " The Effects of Air Pollution on Plant Growth," by Dr. J. K. A. Bleasdale; " The Effects of Atmospheric Pollution on Man," by Dr. J. P. Lawther; and " Fluorosis in Farm Animals." Among the radioactive questions discussed were papers by Dr. H. J. M. Bowen on the uptake of fission products by plants, W. L. Templeton on fission products and aquatic organisms, and Dr. T. C. Carter on the genetic effects of radioactive pollution.

# THE HEADQUARTERS FUND APPEAL

## *First List of Donations*

We give below a first list of acknowledgments for contributions to the Fund that has been opened to assist the Society in its move to new and more suitable offices. If any readers have not received details of the Fund we shall be glad to send them a copy of the Appeal letter, which explains why the fund is necessary. It will be recalled that it was decided upon by the unanimous wish of those present at the recent Annual General Meeting.

The time of year at which the Appeal had to be launched, coinciding with the summer recess in meetings for many of our members, and particularly local authorities, has meant that it has not yet received their consideration. We anticipate that the second list, to be published in our next issue, will include the names of many more local authorities as well as others.

The list that follows include donations received up to 5 September.

**£250.**—Arthur Guinness and Co. (Park Royal) Ltd.

**£100.**—Woodall-Duckham Construction Co. Ltd.

**£75.**—Shell-Mex and B.P. Ltd.

**50 guineas.**—General Electric Co. Ltd.; Refuge Assurance Co. Ltd.

**£50.**—Simon-Carves Ltd.; Imperial Chemical Industries Ltd.; Esso Petroleum Co. Ltd.

**40 guineas.**—Glasgow Corporation.

**35 guineas.**—East Midlands Gas Board.

**25 guineas.**—Solid Smokeless Fuels Federation.

**£25.**—Park Gate Iron & Steel Co. Ltd.; London Electricity Board; Cadbury Bros. Ltd.; Steel Company of Wales, Ltd.

**20 guineas.**—Eastern Gas Board.

**£20.**—South Eastern Electricity Board.

**£18 7s. 6d.**—Southern Gas Board.

**15 guineas.**—W. C. Holmes & Co. Ltd. Petrofina Ltd.

**12 guineas.**—Paisley Corporation; E. Green & Son Ltd.

**10 guineas.**—Electrical Association for Women; James Howden & Co. Ltd.; Walsall Corporation; Gateshead Corporation; Dr. R. Lessing; Ford Motor Co. Ltd.

**£10.**—Anon, Glasgow.

**6 guineas.**—J. Bibby & Sons Ltd.; College of Fuel Technology; George Bray & Co. Ltd.; Huddersfield Corporation; Grimsby Corporation.

**5 guineas.**—Dunedin Engineering Co. Ltd. Radiovisor Parent Ltd.; Musselburgh Corporation; Sir John Charrington.

**£5.**—Dr. K. Hutton; Sir David Anderson; Dr. J. Johnstone Jervis; Tillotsons Newspapers Ltd.; Securite Routiere, Brussels; Mr. J. A. Gillett; Mr. John Gurney.

**4 guineas.**—Wanstead and Woodford Corporation; Slough Corporation.

**£4.**—Anon, Surrey.

**3 guineas.**—Blackwell Rural District Council; Eston Urban District Council; Sunderland Rural District Council; Stanley (Co. D.) Urban District Council; Wallsend Corporation; Llantrisant & Llantwit Fardre Rural District Council; Port Talbot Corporation; Leigh Corporation; Urmston U.D.C.; Brighouse Corporation; Chatham Corporation; Wortley U.D.C.; Longbenton U.D.C.; Seaham U.D.C.; Pontypool U.D.C.

**£3.**—Dumbarton Corporation.

**£2 17s. 6d.**—Spennymoor U.D.C.

**£2 15s.**—Renfrew Corporation.

**2½ guineas.**—Keith Blackman Ltd.; Bolsover Urban District Council; Matlock Urban District Council; Portishead Urban District Council; Pontefract Corporation; Worksop U.D.C.; Penarth U.D.C.; Great Harwood U.D.C.; Padiham U.D.C.; Lanchester U.D.C.; Colne Corporation; Mynyddislwyn U.D.C.; Prudhoe U.D.C.; Staveley U.D.C.

**£2 10s.**—Grantham Corporation.

**2 guineas.**—Dr. H. Toussaint; Dr. A. Parker; Anon, Yorkshire; Alderman J. Robinson; Mrs. H. Jones.

**£2.**—Anon, London; Mr. & Mrs. H. P. Bibby; Anon, London.

**1½ guineas.**—Clitheroe Corporation.

**£1 10s.**—Mr. R. G. East.

**1 guinea**—Anon, Bradford; Anon, Warwickshire; Mr. P. L. Jewsbury; Mr. C. Machen; Anon, Essex; Mr. T. Henry Turner; Anon, Middlesex; Mr. J. G. Elsworthy; Mr. C. A. P. Atkinson; Port Glasgow Corporation; Mr. B. S. Lister; Dr. J. A. Gillison; Mr. W. A. Ballard; Mr. T. W. Pedler; Mr. J. K. Best; Bexendale & Co. Ltd.; P. C. G. Isaac; Dr. A. C. Monkhouse; Mr. T. Paton; Anon, Aberystwyth.

**£1 and less.**—Mr. A. Hall; The Rev. D. H. McNeile; Anon, Sussex; Mr. F. Reynolds; Dr. H. D. White; Anon, Renfrewshire; Mr. H. Wilson; Mr. W. L. Mather; Dr. P. W. W. Gifford; Mr. H. F. Amende; Mrs. G. Templeman; Mr. A. J. Chatfield; Dr. M. Barash; Anon, Newcastle-upon-Tyne; Anon, Sussex; Anon, London; Anon, London; K. A. H., Hooton; Anon, London.

Total to date: £1,324.

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**Mystery of a Petition**

Four hundred signatures on a petition against the proposed smoke controlling of the Swanside area of Huyton are missing and no one could say what had happened to them when a public inquiry was opened at Huyton today.

Mr. S. Burchart, representing the Coal Merchants' Federation and several private objectors, assured Mr. R. H. Heath, the Ministry inspector, that a petition bearing the signatures had been sent to the Ministry and Mr. Burchart said he believed the federation secretary had received an acknowledgment.

Mr. Heath declared he had only a petition signed by 88 signatures as well as six letters from private residents and 16 circular letters.

Mr. Heath said there were no further signatures in his possession. He also asked why nearly all the signatures he had had first been written in pencil and inked over later.

Mr. Burchart said he knew nothing about this and admitted he did not know if it constituted a forgery. He thought the collector of the signatures might have been under the impression that pencil was not legal and had inked over them himself. —Report in *Liverpool Echo*, July 6th, 1960.

**80 per cent. Smoke is Domestic**

The most serious source of atmospheric pollution was smoke, and of this more than 80 per cent. came not from industry but from domestic grates, said Dr. S. R. Craxford, head of the Atmospheric Pollution Division's Department of Scientific and Industrial Research, at Redcar, recently.

More emphasis should be put on this type of pollution, because it was the most difficult to deal with, he said. The industrial problem could be dealt with at its source. It was easy to visit a factory and discuss pollution, but it was almost impossible to deal individually with the tens of thousands of householders who were the chief offenders.

**Coalite**

The Directors' Report and Accounts of Coalite and Chemical Products Ltd., for the year ended March 31st, 1960, show another year of progress and expansion for this, the oldest and best-known of the named smokeless fuels. The report shows a gross profit for the year before taxation of £935,913, and total dividends for the year of 16½ per cent.

# *Mortality, Fog and Air Pollution*

## New Investigation Indicates Predominant Role of Smoke

AN important investigation of the fogs in London during the winter of 1958-59 has been reported by A. E. Martin, M.D., D.P.H. and W. H. Bradley, D.M., M.R.C.P., of the Ministry of Health, and has been reprinted from the Monthly Bulletin of the Ministry (1960, 19, 56) under the title " Mortality, Fog and Atmospheric Pollution."

Much of the report, with charts and tables of a highly statistical character, and the conclusions reached are based on statistical analyses that cannot be summarised or simplified. An attempt will be made, however, to give a reasonably full account of the investigation and of the discussion on the findings.

" Experience over the last twelve years," state the authors, " has shown that in the Greater London area, persistent, dense, smoke-polluted fogs are associated with serious increases in mortality. The effects of less severe fogs are more difficult to demonstrate. Scott (1957) and Gore and Shaddick (1958) have suggested that there may be a critical level of approximately four times the customary winter average of atmospheric pollution above which a marked excess mortality may be expected. Bradley, Logan and Martin (1958) have pointed out that in many of the serious fog incidents an early rise in mortality may be detected often before the atmospheric pollution has reached its maximum. They suggested that a further study of the daily numbers of deaths in the Greater London area might be of use in determining how far relatively minor fog incidents are accompanied by increased numbers of deaths. Such a study was commenced during the winter of 1958-9."

Because of the presence of virus influenza it was decided to confine the investigation to any changes in mortality found within either 24 or 48 hours of a deterioration in atmospheric conditions.

The sources of information are given as follows. *Deaths*—from the General Register Office, which classified deaths in the Greater London conurbation according to the day of occurrence. Total deaths (all causes) and deaths from bronchitis and from pneumonia were tabulated separately. *Meteorological Observations*—readings were taken every three hours at the Air Ministry Observatory, Kingsway, with readings from other stations to confirm that the Kingsway readings were representative of London. *Atmospheric Pollution*—The London County Council supplied daily measurements of recordings at seven stations chosen as representative of the County.

### The Major Fog Incidents

The winter was particularly foggy and during the four months November to February there were 59 days with fog (defined as visibility less than 1,100 yards) and with thick fog (less than 220 yards visibility) on 22 days. There were six particularly severe periods of fog: November 15th to 20th, December 2nd to 4th, and January 14th to 17th. The meteorological conditions are described in the report. During two other periods, November 6th to 9th and December 15th to 17th there was an increase in air pollution associated with either a calm or a very light wind. These periods, as well as each of the six fogs were accompanied by an immediate rise in the number of deaths.

" The increases above the general level were small, ranging from about 70 deaths in the fog of December 2nd to 4th, to 230 in that of January 26th to 31st. Despite the smallness of the increases, the consistency with which

an immediate rise occurred on each occasion is highly suggestive. In four out of the six fog incidents there was also an immediate though small increase in the demands for hospital admission through the Emergency Bed Service for Metropolitan London."

A comparison of the mortality curve with the occurrence of fog and air pollution showed a considerable number of small co-incident peaks, often of only 24-48 hours duration.

" Thus, during the four months there were 34 days with an increase of 20 or more deaths as compared with the number on the previous day. On 21 of these days the black suspended matter in the atmosphere had increased by more than 20 mgm. per 100 cu. metres and on 25 the $SO_2$ had risen by more than 2·5 parts per hundred million. . . . The association between atmospheric conditions and small rises in mortality appeared to be close and a further analysis of the figures was, therefore, made."

It is said that it would be somewhat difficult to apply statistical tests of significance to the figures and that the number of incidents was certainly too small to make dogmatic statements. " Nevertheless, the possibility of there being a true association is increased by the fact that not only were more than two-thirds of the increases in mortality found to coincide with the deterioration in atmospheric conditions, but the converse was also true. In roughly two-thirds of the episodes when there was an appreciable increase in either black suspended matter of $SO_2$ and in all the episodes when there was thick fog, there was an increase in mortality either on the day in question or on the following day."

The report then deals with the final step in the investigation, which was to calculate the correlations between the indices of atmospheric conditions and the figures of mortality, to test the significance of these and to find the effects of combining certain factors by calculating multiple correlation coefficients. The methods and results are detailed and scatter diagrams also used are reproduced. The correlation tests showed a significant positive association between black suspended matter in the atmosphere and the daily number of deaths, a slightly less but still significant association between atmospheric $SO_2$ and deaths and a significant negative association between visibility and deaths.

The most striking feature of the investigation, state the authors, is the apparent effect on mortality of the minor fog incidents and the smaller increases in atmospheric pollution. The greater part of the discussion may be quoted at length, as follows.

" The suddenness of the effect of a deterioration in atmospheric conditions is remarkable. The picture is unfortunately rather complicated as the mean atmospheric pollution for the preceding 24 hours is recorded each day at 12 noon, whereas mortality is expressed as the total deaths for the 24 hours ended at midnight. In most episodes the increase in deaths occurs on the day of the fog, or on the day on which the raised atmospheric pollution was recorded. Occasionally, when the atmospheric pollution had begun to rise later than 12 noon, an increase in mortality was noted on that day, having apparently occurred within 12 hours of the onset of the incident.

" In the great London fog of 1952 it was found that both respiratory and cardiovascular deaths rose rapidly during the fog. The latter fell abruptly as soon as the fog cleared while the respiratory deaths continued at a high level for a few days before falling. (Ministry of Health, 1954). The sudden rises in mortality during the incidents of 1958-59 suggest that many of the deaths occurred either in people who were already seriously ill with respiratory conditions or in those suffering from cardiovascular lesions. The proportion of deaths certified as due to bronchitis or pneumonia was small in comparison with the increases in total mortality and the correlation between each of these conditions and atmospheric pollution was much lower than that between total deaths and pollution. These facts all point to some condition other than bronchitis

and pneumonia being responsible for many of the deaths associated with fog and raised atmospheric pollution.

" A number of cases would undoubtedly have lesions of both heart and lungs. In the London Fog of 1952 the proportion of cases found at post-mortem to have a combined lesion was not high (Ministry of Health, 1954). This observation was, however, based on autopsies by pathologists, many of whom, owing to the large numbers of deaths, were working under heavy pressure and could not always have been expected to have considered an exhaustive search for secondary or contributory causes of death as important as in the case of an *ad hoc* research project. Until recently there has been much doubt regarding the rôle of chronic pulmonary disease as a cause of death in congestive heart failure. Surveys in the Sheffield area (Flint, 1954, Stuart-Harris *et al* 1959) have now indicated that from 25 per cent. to 41 per cent. of cases of congestive heart failure admitted to hospital were suffering from *cor pulmonale* due to chronic pulmonary disease. Stuart-Harris and his colleagues found that the proportion was highest (41 per cent.) in the cases admitted to hospitals in the City of Sheffield and that residence in an industrial environment was commoner in the *cor pulmonale* cases than was residence in other areas. An indication of the importance of the association between respiratory and cardiac disease as a cause of premature death was also observed by Reid and Fairbairn (1958) in a study of chronic bronchitis in postmen. Nearly all the authors in this field note the apparent importance of chronic atmospheric pollution as an etiological factor in these cases. In the acute fog incidents the tendency has been for most workers to seek the effects among the portion of the population suffering from bronchitis and emphysema. The discrepancy which has now been noted between the total increased deaths and the increased bronchitis deaths during fog incidents indicates that the search must be on a wider basis and the future investigations should, where possible, be planned to indicate the relative importance of heart disease and of combined cardio-pulmonary conditions.

" The respective parts played by black suspended matter, by $SO_2$ and by purely meteorological factors remain a matter of conjecture. After the London fog of 1952, the oxides of sulphur were thought to be among the most toxic of the atmospheric pullutants. More recently evidence has been accumulating to show that it is the black suspended matter which has the more predominant rôle. (Scott 1957, 1958, 1959), (Burgess and Shaddick 1959). Among climatic conditions the cold damp air of a fog may of itself have a more harmful effect than is realized, yet examples may be found of raised atmospheric pollution without fog being associated with a rise in mortality. It was hoped that correlation tests would give an indication of the relative importance of these factors but the differences between the coefficients of 0·613, 0·520 and 0·554 for the respective correlations between the Mortality (all causes) Index and black suspended matter, $SO_2$ and visibility are not sufficiently great to be significant. Indeed the low coefficient of 0·554 may be due to the visibility index based on one site alone in Central London being less satisfactory than the indices of atmospheric pollution. The multiple correlation coefficients of 0·59 between the Mortality (all causes) Index, black suspended matter and visibility or of 0·62 between the Mortality (all causes) Index, black suspended matter and $SO_2$ did not show a significant improvement over the zero order correlations of 0·613, 0·520 and 0·507. This indicates that one factor alone might be the agent or medium responsible for the whole of the greater part of the excess mortality but does not exclude the possibility of a combination of the factors. The ratio of black suspended matter to $SO_2$ in the atmosphere of London is tending to fall, probably as a result of the implementation of the Clean Air Act (Scott 1959) and it is

hoped that observations of the association between daily mortality and atmospheric conditions in future winters will yield more definite evidence.

" Temperature is the climatic factor most frequently considered to have an association with fog mortality. Russell (1924, 1926) drew attention to the importance of cold weather as a factor in increasing mortality rates during fogs, but his investigations were based on weekly means and his results are not, therefore, applicable to the immediate effects of individual incidents. By itself, unless well below freezing point, temperature appears to have comparatively little immediate effect on winter mortality and this is exemplified by the low correlation coefficient (—0·030) which was found during the winter of 1958-59. A range of 30-38°F. is characteristic of most winter fogs and temperatures consistently below 30°F. are the exception. At the other extreme several fogs each associated with a mortality peak were found in November and December, 1958, with temperatures substantially over 38°F. As yet details have not been collected by a sufficient number of estimates to estimate mathematically the effect of temperature on fog mortality, but apart from the exceptional incidents with very low temperatures it appears on present information to have a very minor influence.

" In view of the importance of the close association shown to exist between comparatively minor changes in atmospheric conditions and mortality during the winter of 1958-59, it is considered advisable to repeat the investigations in subsequent winters. This will give an opportunity to examine the effect on the numbers of persons certified as dying from cardiac conditions and, as the clean air programme reduces and alters the proportions of the various atmospheric pollutants, may make it possible to define their relative importance. A separate paper is being published on the relation between atmospheric conditions and morbidity."

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## DATA SHEETS ON DUST COLLECTORS

Published by the British Steel Castings Research Association, (Paper covers, price 30s. postage paid).

Equipment for the collection of industrial dusts and fumes has attracted considerable attention, particularly since the passing of the Clean Air Act, the implementation of which will in numerous cases involve the purchase, installation, and regular maintenance of such equipment, not merely by makers of steel castings, but also by many organizations engaged in other sectors of industry.

Many different types of dust collectors have been introduced to the market under various trade names in recent years, making it increasingly difficult for potential users of such equipment to keep abreast of developments in this specialized field.

In order to facilitate the selection of the most suitable unit for a particular purpose, the British Steel Castings Research Association broke new ground by compiling a series of data sheets, giving up-to-date details of specific dust collectors suited primarily to steel foundry applications.

A book, containing these data sheets, was first published in May, 1958, in an Edition limited to Members of B.S.C.R.A. The Association has now decided to make this book generally available in a Second (Revised and Enlarged) Edition—just published.

The data sheets included in this book contain details of 32 dust collectors made by 19 organizations, and as far as possible, the collection efficiency, pressure drop, and water usage of each type of collector are clearly indicated. A diagram, showing the principle of operation, is given in each case.

An introduction, containing comments on types, selection, location and the approximate cost of dust collectors, as well as a table of efficiency curves for each type of collector, are also included in this new B.S.C.R.A. book, the timely appearance of which will, it is hoped, be of value to many organizations.



*Four bottle kilns in the centre of Stoke-on-Trent, once used by Joseph Spode to fire his historic bone china, have just closed down. They are replaced by a new gas-fired tunnel oven, with three times the capacity of the four bottle kilns, at the Spode Works of W. T. Copeland and Sons Ltd. Builders and co-designers with Copeland's own engineers were Gibbon Bros. Ltd., Dudley*



# INTERNATIONAL SECTION*

*Italy*

## POLLUTION IN MILAN

Dr. E. Grosso and Dr. E. R. Massarani of the Institute of Sanitary Engineering, Milan Polytechnic, have published in *Ingegneria Sanitaria* (6, 7, 1959, 201-7) a report on researches on air pollution in Milan: on the behaviour of $SO_2$ determined by means of the lead peroxide instrument. The authors describe the study carried out during the three years 1956, 1957 and 1958, using twelve permanent stations situated in the residential and industrial areas of the city and in some neighbouring centres.

For sampling and analysis of the material from the lead peroxide instrument the authors followed procedures and methods used in England with some variations suggested by experience, a precise description of which is given. The highest sulphur dioxide concentrations (up to 6·82 mg. of $SO_3$/100 $cm^2$/day) have been found at the stations in the residential areas in the centre and neighbouring sectors of the city (Piazza della Scala, Piazza della Republica, etc.) in winter—that is during the period of maximum activity of domestic heating plant. In the stations of the more or less intensively industrialized peripheral areas of the city and of its suburbs (Sesto San Giovanni, Pero) in winter the sulphur dioxide values observed were generally somewhat lower than those corresponding to residential areas (not higher than 3·22 mg. $SO_3$/100 $cm^2$/day for the station of Bovisa). During summer, with heating plants not in use, the sulphur dioxide values of residential and industrial areas showed a tendency to equalize.

The lowest sulphur dioxide values (from 0·05 to 0·17 mg. $SO_3$/100 $cm^2$/day) were observed at the station of Venegono (province of Varese), corresponding to a rural area with small human aggregates and without important industries.

Comparison between the data concerning two stations placed at different heights on the " Grattacielo di Piazza della Republica " confirms that the lower atmospheric layers were the most polluted. The authors conclude that these investigations, like earlier ones on deposited matter and suspended impurities, show that domestic heating plants are one of the main causes of air pollution in Milan.

*Sweden*

## A REVIEW OF AIR POLLUTION

A review entitled " Air Pollution and its Importance," by Dr. Bertil Wedin of the Swedish Research Institute of National Defence, reprinted from the journal of Natural Science, has been published in booklet form. The volume, of 54 pages, has a summary and captions to its illustrations in English, and is attractively printed. It includes information of considerable interest on investigations carried out on the dispersal, both horizontally and vertically, of particles from a given source, using an impactor, designed by the Research Institute for National Defence, which can be mounted on either a car or aeroplane. (We hope to be able to describe this work in more detail in a later issue.)

Dr. Wedin has much to say about the problem in Britain, and about the work being done, including an account of the Clean Air Act. We were gratified to note the excellent use made of

* Further Honorary Correspondents, to the list published in the last issue are Dr. H. Kettner (W. Germany), J. H. Carter (St. Louis, U.S.A.) and L. J. Brasser (Netherlands).

a number of photographs (most of which have been reproduced in this journal) loaned for the purpose by the Society. The author attended the International Conference in London last year, and the report is an outstanding example of the valuable results of the co-operation and interchange of information engendered by the conference.

*Western Germany*

## TAX RELIEF FOR INDUSTRIAL PLANT

Deputies of the German Bundestag have introduced proposals for prolonging the Tax Amendment Law of July 26th, 1958 concerning the special write-off allowances for industrial equipment that serves exclusively for preventing, removing or minimizing atmospheric and water pollution. The law is expected to be extended until December 31st, 1965. As a reason, it is said that many works which principally would like to use this opportunity of write-off could not decide to do so because of the very short time the original law was to be in force—between January 1st, 1957 and December 31st, 1960. (See also *Smokeless Air*, No. 106, Summer, 1958, 263-4.) (*From Dr. Helmut Kettner*).

## NEW NUISANCE LAW

On December 29th, 1959 a new law was passed which changes some sections of the Gewerbeordnung (GewO=Trade Law) and the Bürgerliches Gesetz-Buch (BGB=Civic Code). After sections 16 and 25 GewO all appliances which may cause considerable disadvantage, menace or nuisance to the neighbourhood or to the public at all, must obtain permission. Examinations of the emissions can be demanded by the authorities after the works come into operation and at any time if a nuisance is expected. The authorities can also demand appropriate installation for the continuous recording of the emissions and immissions. A new list of the works to be permitted is being elaborated. If, after receiving permission, a works still causes nuisance, the authorities are empowered to order additional measures for control. These measures must comply with the newest techniques and should be economically reasonable.

After section 906 of the BGB certain conditions for the neighbourhood must be tolerated. If however the nuisance exceeds a certain tolerable limit, which cannot be improved upon by reasonable measures, financial compensation can be required. (See also paper by Dr. Werner Kelm, N.S.C.A. International Conference Proceedings, 1959.)

The amendments to these laws makes it possible for local authorities to require improvements in existing works, which hitherto has not been possible. Basic rules and regulations concerning the new permission conditions will follow. (*From Dr. Helmut Kettner*).

**Conference at Wiesbaden**

A three-day air pollution conference, opening on September 21st, 1960, was held at Wiesbaden under the aegis of the Air Pollution Commission of the Verein Deutscher Ingenieure (V.D.I.). We hope to give a fuller report of the proceedings, and abstracts of some of the papers presented in our next issue.

*France*

## POLLUTION IN PARIS

We have received the report of the Prefecture of the Seine on atmospheric pollution in Paris for 1959. There are measuring stations at the central

Health Laboratory and at twelve other stations, two of which are at the top and the foot of the Tour St. Jacques—all the readings at the top of the tower being higher than those below. Acidity in the atmosphere is recorded in parts per million, and smoke in micrograms per cubic metre. Total acidity ($CO_2$) and sulphur dioxide acidity are measured. The mean $SO_2$ for the centre of Paris is 67 ppmm compared with 62 ppmm in 1958, with the highest figure in the XVI arrondisement, at 93 ppmm. The smoke figure is 162$\mu$ g/m$^3$ for the centre, with a maximum of 184$\mu$ g/m$^3$ near the Goncourt metro station. There is less pollution recorded on Sundays than on any other day of the week.

A report by the Paris prefect of police and the prefect of the Seine department shows that air pollution has tripled in Paris during the past 50 years, and that 45 per cent of this increase can be attributed to motor traffic. It is stated that domestic central heating is responsible for a large proportion of the $SO_2$ in the air, rising to 88 per cent. of the total during the winter.

The prefects' report warns that many of the street trees in the city will be dead by the end of the century if nothing is done.

The remedies are regarded as being to reduce the sulphur content of solid and liquid fuels as much as possible, and to extend district heating systems, thereby reducing the number of individual installations.

New clean air legislation for France is under consideration, which in addition to providing for stricter control over heating installations would also control the pollution from road vehicles, including the output of carbon monoxide, and provisions for the immobilization of diesel vehicles producing excessive smoke.

**Conference Record**

The January-March number of the journal of the Association pour la Prévention de la Pollution Atmosphérique (Vol. 2 No. 1, price 15 NF.) is a special number on the conference held in December last jointly by the Association, C.I.C.A.D. (Centre d'Information pour le Développement du Conditionnement d'Air, de la Ventilation, du Filtrage de l'Air and due Dépoussiérage), and the Institut National de Sécurité.

**November Congress in Paris**

We have just received news of the Congress on Air Pollution, organized by A.P.P.A. to be held in Paris on November 24th to 26th next, under the patronage of the Minister of Public Health and Population. Information may be obtained from the Association at 62, rue de Courcelles, Paris VIII.

Twenty-one papers or addresses are included, covering among other subjects pollution from road vehicles, the cancer hazard, effects on vegetation, work and progress in West Germany, and the presentation of photographs by Dr. R. S. Scorer.

*U.S.A.*

## MOTOR VEHICLE POLLUTION

On June 8th, President Eisenhower signed a bill directing the Public Health Service to study the effects of motor-vehicle fumes on human health and report to Congress within two years. The Public Health Service has in fact been concerned with vehicle-caused pollution for some time. It has conducted its own engineering and medical studies and has financed others. But the new law, in addition to its symbolic importance, may be the herald of Federal legislation giving the Surgeon General new powers to act against air pollution.

Under one pending bill, he would be empowered to hold public hearings on air-pollution problems of broad significance. The bill's sponsor, Arthur S. Fleming, Secretary of Health, Education, and Welfare, said that auto fumes are one such problem and

that the hearings would be an important mechanism in dealing with it.

In our last issue (p. 265) we reported the new "Auto Smog" law of California, which requires the installation on motor vehicles of officially approved devices for the prevention of pollution, when such devices are available and at least two have been certified as approved by a state board. The Air Pollution Foundation Newsletter (San Marino, California) for May-June, 1960 now gives some details of the various factors that enter into this law and its application. They are as follows:

*Scientific factors:* (1) Until engines are invented that emit little or no hydrocarbons in exhaust, afterburners must be used; (2) an afterburner must burn up 80-85 per cent. of *total* hydrocarbons in order to burn up these particular *olefinic* hydrocarbons responsible for smog; (3) such efficiency cannot be attained on a short trip if heat-up time exceeds two or three minutes.

*Engineering factors:* (1) afterburners must be built small enough to fit under passenger cars with easy installation and replacement; (2) in order to take the place of a muffler, they must not only curtail hydrocarbon emissions but also muffle sound; (3) they must be designed to allow quick inspection with simple instrumentation.

*Economic factors:* (1) initial cost should desirably be not more than about $50 above the cost of the present muffler for any given car; (2) since a combination afterburner-muffler will cost more than the present muffler it replaces, it should last at least as long and preferably longer; (3) maintenance should be simple, inexpensive, and not required frequently.

The Newsletter adds: "The legal factor that now tells device developers what they must accomplish for State certification of their product is contained in the standards for exhaust emissions—standards calculated on the basis of an overall 80 per cent. reduction in current average motor vehicle hydrocarbon emissions, *and an overall 60 per cent. reduction in carbon monoxide emissions.* Inclusion of carbon monoxide, which plays no rôle in smog formation, in these standards definitely favours direct-flame afterburners over catalytic devices and may thus rule out some devices that could end smog."

**APCA Convention**

A complete set of the abstracts of the annual convention of the Air Pollution Control Association at Cincinnati in May has been received. A selection of these is included in our Air Pollution Abstracts on page 63. The number of papers presented at the conference, some of which were of U.S. rather than general interest, makes it impossible to print the complete set, but copies of any abstracts, or of the papers themselves, can be supplied by arrangement and at a small copying charge.

*Australia*

## CONTROL OF AIR POLLUTION

Measures to control air pollution are provided in a bill introduced in the New South Wales Parliament last month. Under the proposed Clean Air Act, 1960, an air pollution advisory committee will be set up to make recommendations and advise the Government on regulations and administration of the Act and on the prevention, abatement or mitigation of air pollution.

The committee will consist of 12 members under the chairmanship of the director-general of public health or his nominee, and will include an officer of the Department of Local Government, a chemical engineer and a fuel engineer, one representative each of the University of Sydney, N.S.W. Chamber of Manufacturers and Metal Trades Employers Association, and two representatives of the

N.S.W. Trades and Labour Council.

The Act requires the occupiers of certain scheduled premises to hold a licence under which they will be obliged to observe conditions designed to control the emission of smoke, dust (including fly ash), cinders, solid particles of any kind, gases, fumes, mists, odours or radioactive substances. The holder of a licence may be required to install and operate control equipment, to repair, alter or replace such equipment, or to erect or alter the height of chimneys, approval of the Department of Health will be required before any work of this nature is carried out.

Regulations will be introduced to cover the types of tests to be carried out and records to be kept with respect to the emission of air impurities and consumption of fuel; types of control equipment that may be used and the manner in which they are operated and maintained; and types of fuel burning equipment that may be used in specified areas.

Occupiers of scheduled premises will be required to maintain and operate control equipment efficiently and to observe prescribed standards of concentration of air impurities that may be laid down in regulations.

Scheduled premises embraced by the Act include those used for the manufacture of bricks and pottery, cement, chemicals, plastics or coal gas, and metallurgical works and oil refineries, where such premises have coke ovens, furnaces or cupolas for melting metals, or boilers consuming more than 1 ton of solid fuel per hour. In addition, the occupier of other premises in which there is any fuel burning equipment will be required to observe prescribed standards of concentration of air impurities and may be subject to conditions governing installation, operation, repair or replacement of control equipment.

Air pollution is a world-wide problem that has come to the fore in Australia in recent years as a result of the continued expansion of manufacturing industry in this country. The need for legislative control to mitigate this costly nuisance has been recognized by the introduction of the N.S.W. Clean Air Act, and increased attention is being devoted to the problem in other States.

The financial burden of control measures, estimated at several hundred millions of dollars a year in U.S.A., will fall on those industries compelled to install and operate the costly special equipment required. Research aimed at improving manufacturing processes and fuel economy, and use of the most modern plant and equipment available, could serve the dual purpose of raising overall efficiency and alleviating this burden.

*Iran*

According to Reuter the Mayor of Teheran has launched an all-out drive against exhaust fumes from diesel vehicles and smoke from the chimneys of brick kilns in the capital. His stated aim is to protect the lives of the 1,500,000 inhabitants of the city from what he describes as " this major health hazard."

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**Smoke Investigation**

A team of engineers appointed by the Institute of Road Transport Engineers is to investigate the problems of air pollution resulting from diesel smoke emitted by road vehicles.

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**Smoke Control Procedure**

Local authorities associated with the London and Home Counties Clean Air Advisory Council advocate the simplification of procedure and administration in connection with smoke control orders. It is suggested that where a local authority have resolved to bring the whole of their area under smoke control orders within a definite period, the approval in principle of the Ministry should be available at the outset and then the practice of submitting details of each area individually for approval in principle would not be necessary.

# SMOKE CONTROL AREAS

## Progress Report

### POSITION TO JUNE 30th, 1960—TOTALS

| | England and Wales | Scotland |
|---|---|---|
| **Smokeless Zones** (Local Acts) in Operation .. | 44 | 1 |
| Acres, 3,400 | | |
| Premises, 41,060 | | |
| **Smoke Control Areas in Operation** .. .. | 154 | 3 |
| Acres, 18,894 | | |
| Premises, 117,366 | | |
| **Smoke Control Orders**— | | |
| Confirmed .. .. .. .. .. | 140 | 7 |
| Submitted .. .. .. .. .. | 99 | 3 |
| Proposals Notified .. .. .. .. | 281 | 13 |
| Not Confirmed (*Deduct*) .. .. .. | 1 | — |
| **Grand Totals** .. .. .. .. | 717 | 27 |

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Summer, 1960), which gave the position up to April 30th, 1960. They now show the changes and additions to June 30th, 1960.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

### ENGLAND AND WALES

#### New Smoke Control Areas in Operation

Brentford and Chiswick B. No. 1, *Brentwood U.D. No. 1, Brighouse B. No. 1, *Crawley U.D. No. 1, Denton U.D. No. 2, Felling U.D. No. 1, Hayes and Harlington U.D. Nos. 8 and 10, Horsforth U.D. Nos. 1 to 7, Leeds C.B. No. 3, Liverpool C.B. Nos. 8 and 9, Mansfield B. No. 1, Middlesbrough C.B. No. 1, Reading C.B. No. 2, Saddleworth U.D. No. 1, Salford C.B. No. 3, Southall B, No. 1, Stalybridge B. Nos. 3 and 4, Stoke Newington M.B. No. 3, Wednesfield U.D. Nos. 1 to 3, Whitefield U.D. No. 1.

#### New Orders Confirmed but not yet in Operation

Altrincham B. Nos. 1 to 3, Ashton-under-Lyne B. No. 1, Bethnal Green M.B. No. 1, Bootle C.B. Nos. 1 and 2, Droylsden U.D. Nos. 3 to 7, Exeter C.B. Nos. 1 and 2, Hammersmith M.B. No. 2, Hayes and Harlington U.D. No. 13, Heywood B. No. 1, Holborn M.B. No. 3, Hyde B. No. 1, Newcastle-upon-Tyne C.B. No. 2, Nottingham C.B. No. 1, Prestwich B. No. 2, St. Pancras B. No. 2, Scunthorpe B. No. 1, Southall B. No. 2, Staines U.D. No. 1, West Bromwich C.B. No. 5, Wilmslow U.D. Nos. 1 and 5, Winsford B. No. 1, Yiewsley and West Drayton U.D. No. 1.

#### New Orders Submitted for Confirmation but not yet Confirmed

Aireborough U.D. No. 7, Birmingham C.B. Nos. 4 and 6, Bolton C.B. Nos. 11 to 14, Brentwood U.D. No. 2, Bristol C.B. Nos. 2 to 5, Connahs Quay U.D. No. 1, Crawley U.D. No. 2, Hayes and Harlington U.D. No. 18, Irlam U.D. No. 1, Leek U.D. No. 1, Leyton B. No. 1, Long Eaton U.D. No. 1, Middleton U.D. Nos. 2 to 6, Southport C.B. No. 1, Stockport C.B. No. 2, Tottenham B. No. 2, Wallasey C.B.

No. 5, Walthamstow B. No. 1, West Ham C.B. No. 1.

**Proposals Notified to the Minister**

Aldridge U.D. No. 6, Altrincham B. Nos. 4 and 5, Bermondsey M.B. No. 3, Bethnal Green M.B. No. 2, Bolton C.B. Nos. 15 and 16, Church U.D. No. 2, Croydon C.B. No. 3, Eccles B. No. 1, Halifax C.B. No. 3, Lambeth M.B. No. 2, Liverpool C.B. No. 12, Middlesbrough C.B. No. 2, Nottingham C.B. No. 2, Sheffield C.B. No. 7, Stoke Newington M.B. No. 10, Stoke-on-Trent C.B. Nos. 7 to 10, Southampton C.B. No. 1, Wallasey C.B. Nos. 7 to 9.

## SCOTLAND

**New Smoke Control Areas in Operation**

Nil.

**New Orders Confirmed but not yet in Operation**

Clydebank No. 1.

**New Orders Submitted for Confirmation but not yet Confirmed**

Dundee No. 2, Edinburgh No. 3.

**Proposal Notified to the Minister**

Dumbarton Nos. 3 and 4, Edinburgh (Sighthill No. 3) No. 4.

# CLEAN AIR ACT CASES

**Section 1—High Wycombe**

High Wycombe borough's first prosecution under the Clean Air Act, believed also to be the first in the county, resulted in a £10 fine for E. Gomme Ltd., the furniture manufacturers, at High Wycombe magistrates court on May 11th.

**Section 11—Rotherham**

The Magistrates agreed on June 16th to the withdrawal of summonses against five miners living in the Kimberworth Park area. They were on adjourned summonses relating to the emission of smoke from their living room chimneys in February and March. Mr. A. S. Wait, the Corporation solicitor, who applied for the summonses to be withdrawn, said that as there was no sign of a settlement at a national level over the question of concessionary coal for miners it was considered unfair to proceed further with the summonses.

The chairman, Mr. J. H. Dickinson, said the Magistrates had in mind that one case had already been before the court and a householder had been convicted. It seemed grossly unfair that that man should have a conviction registered against him when the Corporation was asking for the withdrawal of other cases. Summonses should not be issued as a means of bargaining at any level.

Mr. Wait replied that the offences had been made out in law and, presumably, the Corporation could proceed and get convictions. This would mean that there would be six people instead of one treated unfairly.

**Section 1—Nuneaton**

Nuneaton Corporation's first prosecution under the Clean Air Act was dismissed at the local magistrates court on May 9th. Stanley Bros. Ltd., of Croft Road, Stockingford, had pleaded not guilty to four summonses which alleged emissions of smoke contrary to the Act. Mr. R. F. Kent, prosecuting, said pollution in Nuneaton was considerable, both from industrial and domestic fuels. Records showed that pollution was above the average for the county, including Coventry. Mr. R. Walker, a public health and smoke inspector, said he kept watch on January 27th and a Stanley Bros. chimney emitted dark and black smoke for 16½ minutes. On February 4th dark and black smoke was emitted for 24½ minutes and dark smoke for 4½ minutes.

Frank Wilkinson, managing director, blamed shortage of suitable fuel. The company, he said, were one of the pioneers in the area for minimizing smoke emission. They had cut out three boilers and he claimed they had achieved an 80 per cent. reduction in smoke emission.

Mr. T. W. Cocks, defending, submitted that there must have been some peculiar circumstances to have caused this emission of smoke. A lack of suitable fuel resulted in the use of the only available fuel.

[*We hope to continue to report court cases taken under the Clean Air Act, but only those which have some special point of interest. A file of cases of which we have Press or other reports is maintained in the Society's library, classified according to the section of the Act concerned, and information on these, or copies of reports, can be obtained on inquiry to the Information Officer.*—**Ed.**]

# *New Report on Alkali, &c., Works*

## Increased Number of Complaints

**96th Annual Report on Alkali, &c., Works, by the Chief Inspectors, for 1959. pp. 69. H.M. Stationery Office. 4s. net.**

THE number of complaints of industrial air pollution received by the alkali inspectorate in 1959 was one-third more than in 1958 and more than double the total for 1957. This increase, says the annual report of the Chief Alkali Inspector for England and Wales (Dr. J. S. Carter) is a measure of public awareness of the nuisance.

The Inspectorate's task is to ensure that air pollution from a great variety of industrial processes is reduced to a minimum. Until 1958 they were mainly concerned with processes in the heavy chemical and allied industries; but in 1958, as a sequel to the Clean Air Act, 1956, the scope of the Alkali Act was greatly extended to include many other operations (for example, iron and steel manufacture and electricity production) where the control of smoke, grit and dust presented problems of special technical difficulty.

Generally speaking, processes have been brought under the Act where emissions are particularly dangerous or offensive, or for technical reasons and where there is particular difficulty of control.

During 1959, specific complaints concerning 354 works were investigated, mainly at the request of local authorities. This compared with 270 in 1958 and 133 in 1957. The degree of justification for complaint varied.

Complaints were most numerous against gas and coke works (63), ceramic works (51), electric power stations (31), and iron and steel works (30). There were also 15 complaints against particular areas, for example, a highly industrialized area or one of intensive production. Examples are the Thames-side area (cement), Trafford Park area (heavy industrial and chemical), the Aldridge area (blue brick production) and three Pennine areas (limestone operations and lime burning).

By comparison, the number of calls for the inspectorate's help in dealing with colliery spoilbanks is steadily decreasing. In 1946, 290 visits were paid by the inspectorate to or in connection with colliery spoilbanks; in 1949, 200; in 1954, 107; in 1957, 55; in 1958, 32 and in 1959, 19.

" By and large the local authorities should now be able to deal with this form of air pollution," remarks the report.

### Cement Works

The report notes the increase of cement production from ten million tons in 1958 to almost 12 million tons in 1959, and continues, " The combination of increased production and the driest summer for 200 years led to an accumulation of dust on buildings and vegetation that was both widespread and noticeable. Under these circumstances it is hardly surprising that there was much public complaint, and especially in the region of intensive production on Thames-side."

After describing the steps taken and planned to reduce the pollution from cement works the report says that away from Thames-side, dust deposition related to smaller areas. " Nonetheless," it continues, " much of the complaint was justified and dust

deposition was evident in many places until the end of the dry spell." The report adds that at some works the complaints related to " blebs " often the size of confetti falling within a short distance of the chimneys. Cause of the " blebs " is rather obscure though the inspectors now have some useful pointers.

**Iron and Steel Works**

Production of pig iron in England and Wales in 1959 was 12 million tons, and of crude steel 18 million tons, notes the report and continues: " We are under no illusions as to the magnitude of the tasks facing us. Nonetheless, progress has begun. We are now beginning to be able to assess the various problems, with some processes even to see the broad lines along which eventual success is possible and, in some directions, not only to be able to make definite recommendations but to have had them accepted and fume plant installed or ordered."

At some works experiments have been or are being carried out to establish the type of fume plant likely to be needed. This is necessary because of " the great and fundamental changes likely to occur in the industry," and because of the considerable cost of dust and fume plant. The report goes on: " In some instances the trials have already been sufficient to indicate the type of fume plant likely to be needed. In others further time is clearly needed. It would be unwise to proceed too fast. There is still much to be learned by trial and error. Nonetheless, some major decisions must be made by the industry and by the inspectorate, and many of them in 1960, concerning processes involving large scale use of oxygen, whether in pre-refining, or in the newer pneumatic processes or applied to the more orthodox techniques."

**Power Stations**

These range from small peak load stations of under 10 megawatt capacity to super-power stations capable of burning thousands of tons of fuel daily.

As in 1958, the very small stations accounted for a " disproportionate amount " of the considerable volume of complaints. All these stations are doomed, says the report, as the Central Electricity Generating Board is actively engaged on closing them. Meanwhile, the inspectorate is doing what it can to ensure that emissions are kept to a minimum.

The medium sized power stations of about 60 m.w. upwards have perhaps the most serious problems. The report presumes that these have still a fairly long life before them, and says they have " an appreciable potential nuisance value." It is " somewhat disturbing " that at some stations emissions have been found to be due to poor maintenance of arrestment plant resulting in its operating below maximum efficiency. After discussions, the C.E.G.B. have undertaken to pursue the maintenance problem vigorously at all stations, and other remedies are being considered.

" Once we are assured that all existing grit arrestors are well maintained and operating at somewhere near their maximum efficiency the whole problem can again be reviewed," says the report. It adds that the problems of emissions at the big new power stations of 1,000 m.w. and over are largely solved at the design stage.

**Gas Works**

The number of works fell from 477 to 454 largely as a result of the industry's policy of concentration. In England and Wales 45·5 million tons of coal were carbonized in coke ovens and gas works.

There were more complaints against gas and coke works than any other class of works. They present "very difficult problems and are likely to do so for some considerable time."

Emissions from one type of works—those employing horizontal retorts—present " an almost insoluble problem." Use of this type of plant is declining and " from a clean air view-

point their eventual demise will be unlamented."

Coke ovens are normally much larger than gas works so that the unit air pollution problems are greater.

"They present one of the most formidable problems and there is long-standing and continuing complaint against many of them. In the mining and steel producing areas heavy pollution from coke-oven plants has in the past often been accepted as a matter of course; there are signs that this attitude of mind is disappearing. Where coke ovens are situated near residential areas complaint can be and often is extremely bitter. In some cases conditions have been made worse by trial scale and also full scale manufacture of reactive solid smokeless fuels by a technique which includes under-carbonization."

**Potteries**

There were 51 complaints against ceramic works in 1959 compared with 43 in 1958. But, the report notes, "they have lost to gas and coke the doubtful eminence of being the most complained-against class of works."

## SCOTLAND

The major pollution problem in the iron and steel industry in Scotland last year lay with seven works out of a total of 31.

The report of the Chief Inspector for Scotland (Dr. E. A. Balfour Birse) for 1959 states that the major units had taken the initiative in seeking solutions and already had some success.

Details are given in the report of the inspections carried out in various industries into air pollution, radioactive waste, cement works, and other production processes in Scotland.



*Photo Library* *By A. Johns*

**Dawn over the City**

# *The Clean Air Act*
# *Architectural and Planning Considerations*

**by Alexander Steele**

**D.A. (Edin.), A.R.I.B.A., F.R.I.A.S., City Architect, Edinburgh**

*A Paper presented at the Aberdeen Conference of the Scottish Division, N.S.C.A., May, 1960*

THE advent of the Clean Air Act will probably have a tremendous impact on the work of the architect and there can be no doubt that with clean air there will be a greater incentive to experiment with colour and to use it with a reasonable hope of ultimate success.

It must not be assumed however, that the architects work is confined to the purely visual effects which his design will give. It will mean a tremendous change in the planning of his buildings.

Architects of all ages until a few years ago created their designs on the basis that there was such a thing as a prevailing wind and we are now becoming aware of the fact that this prevailing wind was largely fictitious. We believed in it implicitly because most of the trees in Britain bend away from the south west but the weather charts provided by the B.B.C. show that the wind blows from a great number of directions other than that normally dubbed prevailing.

The boilerhouse was always placed, if at all possible, in the north east corner of the site and many plans were unduly distorted in an endeavour to acquire what was assumed as the ideal situation.

Vast improvement in the design of heating installations and in the equipment associated with these installations has shown that the positioning of the boilerhouse is not nearly so important. It is not only in the large installation that the architect enjoys greater freedom as the advent of improved equipment for gas and electric heating has freed him from one of the bugbears of designing the open fire so that the occupants of the rooms will not be subject to excessive draughts.

If this country is to have clean air, and it is a very long time since people started thinking about this, it does appear that a more positive step has now been taken and it seems that a serious attempt is being made to attain better standards. I came across a very interesting book by Mr. W. C. Popplewell, entitled the Prevention of Smoke. This book was published in 1901 and contains evidence that various Commissions had been looking into the problem for a long time and in Section 295 of the Edinburgh Municipal and Police Act of 1879 there is a direct reference to the creation of smoke and penalties are defined for continuance of nuisance.

## National Lead Needed

Many business people believe that if one waits until there is complete agreement about a project then it is too late. It would seem that we have waited until everybody has finally agreed about clean air—perhaps in this instance it is not too late. I do not think it would be out of place to draw attention at this point to the fact that a stronger national lead should really be given if the available sources of energy are to be used to the best advantage of the country.

One must concede that it is possible with any of the fuels available today to provide installations which will burn satisfactorily with the least possible emission of smoke but coal can only be burned naturally in the larger type of boiler fitted with automatic stoker and having a reasonable

amount of instrumentation to ensure the proper standard of efficiency.

The rival merits of coal, oil, gas and electricity tend to add an unnecessary complication at the design stage and there are many occasions when insufficient consideration is given to this question by clients and architects during the briefing period.

The type of energy to be used in a building can only be determined after a detailed analysis of the problem and it is unfortunate that so many schemes progress without due regard to the total implication of using a particular fuel.

To take coal as an example, and here I feel this is one of the items which should be considered at national level, there is the problem of disposing of the residual ash and while the cost of this does not directly affect the building owner it is undoubtedly reflected in the increased cost of local rates which must be paid. Every ton of ash can cost a local authority a substantial amount per ton for disposal.

A considerable amount has been written about this problem and the Lighting and Cleansing Manager in Edinburgh has made a careful analysis of the changes which are to be expected from the use of forms of heating where there is virtually no ash content. This is shown by the fact that in the old type of tenement the dust and cinders content of refuse was 66·5 per cent. whereas in the all-electric flats, this had reduced to 1·97 per cent. while the amount of putrescible material had risen by 37 per cent. and the paper content by 27 per cent.[1].

In general terms I suggest that insufficient consideration is given by small and large user alike to the labour content of the expense of running the installation.

One of the greatest problems facing the designer at the present time is that the world of building, in its broadest sense, is subject to very rapid change and one can foresee great alterations in the standards to which we have become accustomed.

**Windows**

Let us consider for the moment the present tendency towards larger windows. Here is a treatment designed to give the maximum amount of light, yet on the other hand, one hears suggestions that this is an extravagant form of building as it increases the cost of heating although the transmission of heat through glass varies with the source of heating and depends on the wavelength of the particular form of heating employed. This point of view was expressed in a recent paper dealing with experiments in underfloor and space heating on the basis that ordinary window glass is " opaque " to long wave thermal rays emitted from low temperature radiant bodies and that the majority of the rays are reflected back into the room. With short wave emission from a high temperature source of heat such as electric, gas or coal fires, or electric lamps about half of the rays pass through the glass.[2]

Perhaps the point to be noted is that many of the more recent developments still have to undergo a period of trial and error supported by a considerable amount of research.

There are also problems associated with ventilation which are directly connected with the problem of heating. The open fire and the gas fire require connected flues and these can provide adequate ventilation and quite often an excessive amount of ventilation.

On the other hand with any form of emission from a radiator or with electric underfloor heating the problem of ventilation has to be given serious consideration.

These are just two of the items at stake and the whole pattern may be altered when the regulations are published which are being prepared following on the passing of the recent Building Act. It is to be hoped that these regulations will permit the use of the latest forms of appliances and that they will define very precisely the standards of heating and ventilating to be attained in different types of heating.

## Types of Heating

In the following paragraphs I offer some thoughts on the various types of heat which are commonly used and pin point some of the faults to which they are subject:

The first and basic consideration in Britain has been and for some time to come will probably be the use of raw coal. It is unfortunate that this can only be used efficiently in specially designed appliances and it is doubtful if there will be any demand in the future for large coal as most appliances are being designed to use the smaller sizes. It is certainly an efficient material for use in boilers controlled by an automatic stoker and of course in the larger plant one can go so far as to pulverize the fuel.

The modern plant tends to use the induced draught fan rather than depending on the natural flow of air on which the earlier boilers were designed. This gives a greater degree of control and while it is possible to eliminate smoke to a very great extent, there is a tendency to emit an amount of grit from the chimney which can be quite a nuisance.

The second type of fuel which has not been used in the smallest type of installation is oil and it must be admitted that architects find this an attractive form of energy as the storage space need not be immediately accessible, the control mechanism is less bulky and the heating response is more rapid than can be obtained by the use of coal. This is extremely valuable where variable loads are encountered. The only problems likely to arise are those of smuts being emitted from the chimney and while these might not have a great impact on buildings, they are most objectionable where washing is being dried in the open air.

One naturally follows these fuels with gas, being a by-product of coal and oil, which in the smaller house is easily installed and easily maintained. It does, however, under the by-laws at present in force in Edinburgh require that the chimney shall go to a higher level than the adjoining windows and this means that there is little saving in the cost of the structure.

Many appliances of the balanced flue type could be used in buildings in positions which would make for easy planning were it not for this requirement about flues.

## Coke

When one is thinking of gas, one's thoughts automatically turn to coke and it is probable in this field that the greatest developments will take place during the next decade.

It seems almost certain that the success of the Clean Air Act will depend upon the availability of smokeless fuels and in most parts of Scotland these will either have to be coke or some form of manufactured material as there would certainly be an insufficiency of hard coal to meet the demand.

A certain amount of caution is necessary in the switch-over to the general use of coke and while this will have been made much easier by the forward thinking of the Department of Health in listing approved appliances, it is vitally important to provide for the education of the householder in the proper use of fuel.

It may be that the designers of the modern appliances have not fully appreciated the problems of clearing ash and unless tenants are almost meticulous in this matter, considerable trouble can be experienced through the burning out of fire bars.

The general use of coke will necessitate provision for ignition of the fuel and for increased storage capacity and it is of value to note that the Scottish Gas Board in their awareness of these problems have introduced a special fuel, " Gloco " to give improved performance over normal coke. This new fuel is derived from selected high grade coal and reduces ignition time considerably; it is delivered in special bags to provide dust free delivery and being much more consistent in burning qualities seems to meet some of the

criticisms which have been made about coke generally.

None of the foregoing types of heating offer much scope for the architect to develop schemes for the more effective use of space excepting of course those heat producing installations which are linked to some form of circulating air system or perhaps some form of radiant heating. The greatest freedom is likely to be obtained from the use of electricity and it is on this aspect of national fuel policy that a plea is made for an early declaration of intention, particularly in respect of tariffs. Much publicity has been given to the favourable aspects of " off-peak " electricity but many are beginning to doubt if this is an effective medium for the small house. The introduction of modified " off-peak " schemes seems to indicate that in the long term there will be a flat rate for electricity. Buildings are designed and built to last a very long time and it is of national importance that every advantage should be taken of a source of energy which is becoming available in increasing quantities.

The architect has still one problem to overcome before he is entirely released from the bondage of the open fire and that is the inherent desire of almost every householder to have a focal point in the room round which the family can muster. That there is no real comfort in such an arrangement seems to be of little consequence and one can only hope that time will reveal the advantages of a house with comfort conditions throughout.

Clean air will mean a new era in design and the architect of the future will be able to approach his work with a sense of freedom which does not exist at the present time. The change will be almost imperceptible and it may well be that the Clean Air Act will not get its fair share of credit in the final assessment of the improved standards of living which are bound to accrue.

### References

[1] Modern Trends in Public Cleansing Practice Overseas—N. G. WILSON, B.SC., F.INST.P.C.

[2] Experiments and experiences in underfloor and space heating. Paper presented to East and West Ridings Regional Conference, National Housing and Town Planning Council by S. HOLMES, A.INST.F., A.R.S.H., Chief Heating Engineer, Leeds Corporation.

# THE CAMPAIGN AGAINST DIESEL SMOKE

The following news items about the growing concern over black smoke from diesel road vehicles will be of special interest in view of the papers and discussions on this problem at the forthcoming Harrogate Conference of the Society.

*Motor Transport* (July 22nd, 1960) publishes a letter from Mr. R. Rust, on observations made during a private survey of black smoke emissions from vehicles using Archway Road hill in North London. Two evening surveys were carried out, and the classified results are given in two tables. It will be noted that in the second the private operators have been divided into C licence and private enterprise hauliers.

On the first day, 41 per cent. of the 255 vehicles observed were smoking, and on the second day 39 per cent. of the 168 observed.

| *Class* | *No. Observed* | *Smoking No.* | *Smoking %* |
|---|---|---|---|
| *July 6th*, 7.10 *to* 8.30 *p.m.* | | | |
| Private operators .. | 189 | 81 | 43 |
| B.R.S. .. .. | 34 | 14 | 41 |
| London Transport | 30 | 7 | 23 |
| Coaches .. .. | 2 | 2 | 100 |
| *July 12th*, 8.30 *to* 9.45 *p.m.* | | | |
| C licence .. .. | 18 | 6 | 33 |
| B.R.S. .. .. | 44 | 23 | 52 |
| Private hauliers .. | 78 | 30 | 38 |
| London Transport | 18 | 4 | 22 |

The writer states that " certain

models were more persistent offenders and large and well-known hauliers were as much to blame as the smaller men . . . Among them were some obviously new and immaculately turned-out ones which were emitting as much if not more smoke than some 20-year-old outfits."

In an editorial comment *Motor Transport*, noting these conclusions, says: " An accusing finger here points at the vehicle manufacturer either for errors in design or for making use of an unsuitable engine in order, perhaps, to cut prices in a highly competitive market. If this is so, then in the long run it will prove to be bad commercial policy."

The editorial goes on to say that the residents in the survey area are shown to have been justified in the complaints they have made about black smoke.

" Relatively small in number, they nevertheless represent a greater mounting public indignation as the result of which the Government may well take punitive action unless something is done soon and seen to be done by the transport industry to remedy the situation. While there is no evidence that diesel fumes are harmful to health, they are undoubtedly unpleasant and indicate fuel wastage and may be sufficiently dense to be dangerous to other road users."

**Anti-Smoke Dope**

*Motor Transport* also gives information (July 8th, 1960) about an anti-smoke additive that has been introduced for diesel fuel and which involves no change in the specific gravity of a fuel and does not impair fuel consumption. It is isopropyl nitrate, which when added to fuel oil improves its ignition quality (the cetane number). The fuel burns more cleanly and completely, there is less combustion delay, which results in less noise, and the load on the working parts is reduced.

Isopropyl nitrate is made by the Nobel Division of I.C.I. Ltd., and is being marketed under the name Isotane by United Lubricants, Ltd., (1 Cromwell Place, London, S.W.7). One of the smaller oil companies, British Viscoleum Fuels, Ltd., Viscoleum House, Lancelot's Hey, Liverpool 3, is at present offering a fuel oil doped with 0·5 per cent. isopropyl nitrate and having a sulphur content of only 0·07 per cent. The doped fuel costs about 1d. a gallon more, but *Motor Transport* considers that even though it may be used only to help to reduce smoke it may in the long run be economic because of the smoother combustion, reduced working stresses and softer combustion deposits, which should help to improve engine life and reliability substantially. It points out that a doped fuel cannot be expected to cure bad cases of black smoke arising from overfuelling or poor maintenance.

**Prosecutions**

Recent prosecutions for smoke from vehicles have included one at Chadderton, Lancs., with a fine of £1; one at Norton, Yorks., also with a £1 fine; and one at Lancaster in which the driver was fined £1 and the owner £5.

**In the Commons**

An adjournment debate on diesel fumes from vehicles took place in the House of Commons on July 25th. Mr. Dudley Smith (Brentford and Chiswick) and Mr. Gresham Cooke (Twickenham) were the speakers, to whom a reply was given by Mr. John Hay, Parliamentary Secretary to the Minister of Transport. The difficulties of improving legislation, and of obtaining precise evidence, were stressed by Mr. Hay. He mentioned the work being done at Warren Spring and endorsed a suggestion made by Mr. Cooke—that " members of the public who have to put up with this nuisance, and who follow a vehicle which is emitting clouds of black smoke, should personally take matters into their own hands, and report to the owners of the vehicle that they saw that vehicle with that registration number at a certain time at a certain place emitting clouds of black smoke."

# *Heights for New Industrial Chimneys*

by

**G. NONHEBEL**

*In our last issue we published the body of the paper presented by the author to the Institute of Fuel on 23rd May, 1960. We now reprint Appendix 1* to the paper, which is headed:*

**Calculation of Height of Chimney to Secure Specified Ground-Level Concentration of $SO_2$ and Specified Rate of Dust Deposition**

## 16. BASIS OF CALCULATION

The following method of calculation assumes that a discharge of flue gases from a chimney rises to a height determined by the Bosanquet formula[15] and that the maximum concentration at ground level may then be calculated by means of the Sutton equation[4] for the diffusion of a plume from an elevated point source.

### 16.1. Meteorological Parameters

| | |
|---|---|
| Temperature | The temperature of the atmosphere is assumed to be 15°C. (60°F.). |
| Density of flue gas | This may be assumed, without appreciable error, to be that of air at the same temperature. |
| Wind speed | Wind speeds at various heights have been reviewed in the Appendix to the paper by Hawkins and Nonhebel.[13] The most frequent wind speed measured at 70 ft. is 8-12 m.p.h. and it is assumed that the wind speed varies as the one-seventh power of the height above ground. In Figs. 3 and 4 allowance is made accordingly. At 400 ft. the most frequent wind speed is around 20 ft./sec. (13½ m.p.h.). In the calculated examples (see Table 7) the plume height is 170-190 ft., the wind speed being taken as 16 ft./sec. Calculation using several formulae for the path of chimney plumes shows that the highest g.l.c. of $SO_2$ occurs when the wind speed is 20-25 ft./sec., irrespective of height of plume. |
| Velocity of efflux from chimney | For simplicity, velocities of efflux are taken as 50 ft./sec. for gas rates over 60,000 ft.³/min., and 30 ft./sec. for smaller gas rates. |
| Diffusion coefficients in Sutton formula | In the Sutton formula, the maximum ground-level concentration $P_{max}$ varies directly with the ratio of the vertical ($C_z$) to the horizontal ($C_y$) diffusion coefficients (see equation 6). The values of these coefficients vary with height and atmospheric conditions and with the nature of the ground, including buildings, beneath the plume. In this Paper, a ratio of unity for these coefficients has been taken, as proposed by Bosanquet, and found experimentally by Stewart *et al.*[17] for stable atmospheric conditions. |

### 16.2. Sutton Equation for Maximum Ground-level Concentration

In practical units, the Sutton equation may be expressed as:

* Appendix 2, on "Derivation of a Formula for Threshold Visibility of a Dusty Plume," is not reprinted here.

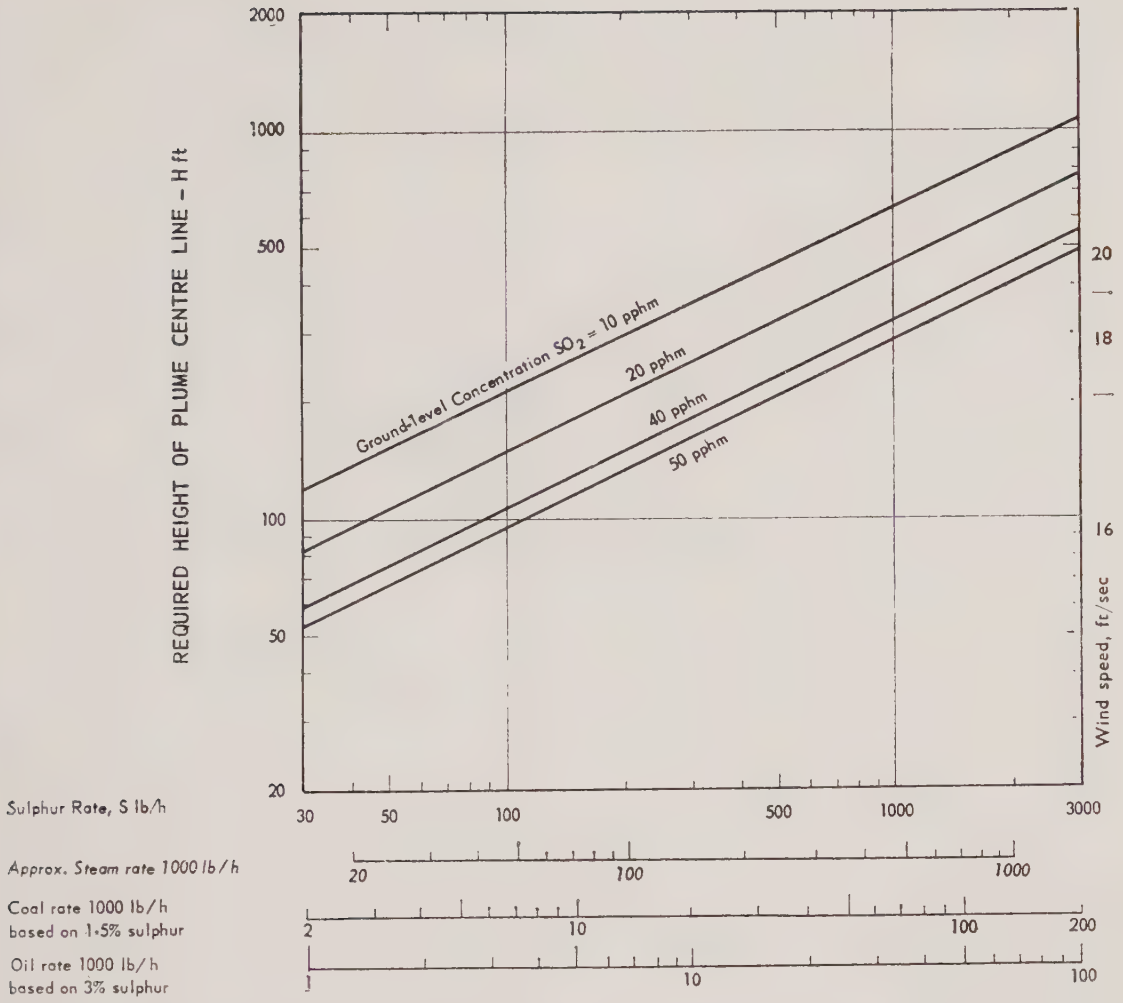



*Fig. 3. Required height of plume for specified ground-level concentration of $SO_2$ from given rate of emission*

$$P_{max} = 75 \times 10^3 \left(\frac{C_z}{C_y}\right) \frac{S}{uH^2} \quad . \quad (6)$$

where $P_{max}$ = maximum ground-level concentration of $SO_2$ in pphm;
$S$ = weight of sulphur, emitted as sulphur oxides, lb./h.;
$u$ = wind speed, ft./sec.;
$H$ = height above ground to which plume rises, ft.

When the ratio $C_z/C_y$ is unity, equation (6) is equivalent to the form of the Sutton practical equation quoted in Appendix VI of the Beaver Report.

Similarly, the distance $X_{max}$ from the base of the chimney at which the maximum g.l.c. occurs is dependent on $C_z$, the vertical diffusion coefficient, and Sutton's wind parameter $n$.

Taking values suggested by Bosanquet of $C_z = 0{\cdot}27$ ft.$^{\frac{1}{8}}$ and $n = 0{\cdot}25$,

$$X_{max} = 4{\cdot}5\ H^{1.14} \text{ ft.} \quad . \quad . \quad (7)$$

## 17. Graphical Method for Determining the Height of Chimney to give a Specified Ground-Level Concentration of $SO_2$

### 17.1. Postulate

The height of the chimney of a new plant is to be such that the additional concentration of $SO_2$ at ground level is not to exceed the recommended maxima given in Section **11.4** for the calculated three-minute mean.

(It is usually found in practice that with boiler plants having only one or two chimneys, the height of chimney is controlled by either the $2\frac{1}{2}$ times rule or rate of dust deposition.)

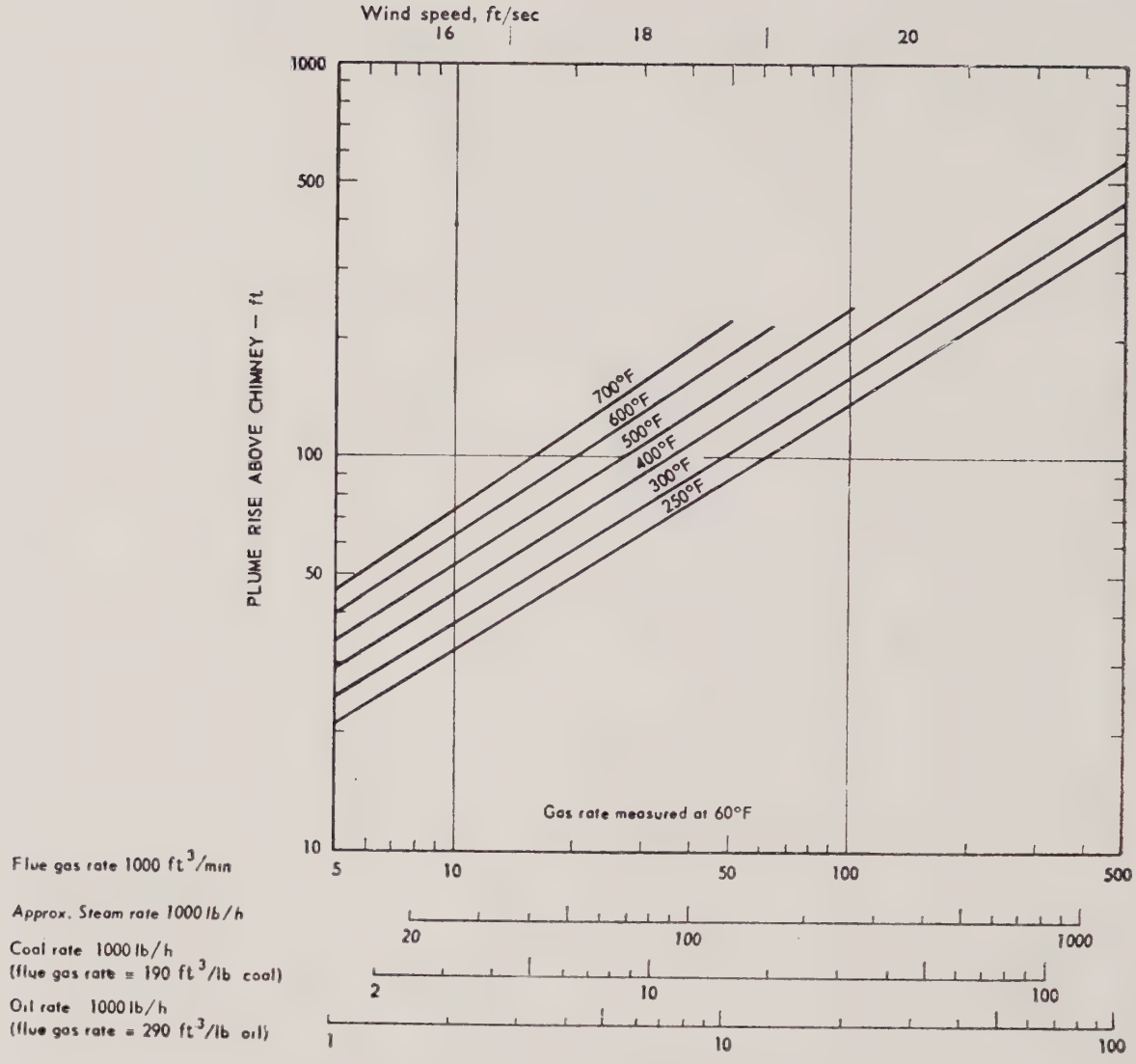



*Fig. 4. Plume rise plotted against flue-gas rise*

### 17.2. Number of Chimneys

Where more than one chimney is to be used for the new plant, the allowable additional concentration must be divided by the number of chimneys unless they are widely separated. Thus, with the wind in line with two chimneys separated by as much as 10 chimney heights, the maximum g.l.c. can be shown to be 1·8 times that derived from each chimney.

### 17.3. Method of Calculation

(*a*) From Fig. 3 obtain the height of plume centre-line corresponding with the rate of sulphur emission from the fuel fired at maximum continuous rating and the required ground-level $SO_2$ concentration. (The subsidiary figures on the abscissa of Fig. 3 for corresponding steam outputs with coal and oil firing and for flue-gas rates are approximate only but useful for initial computations.) For other wind speeds, use equation (6).

(*b*) From Fig. 4 read off the height to which the plume rises above the chimney corresponding with the flue-gas rate and its temperature at the chimney mouth, both for maximum continuous rating. For other wind speeds it is convenient to use the graph given by W. F. Carey in the discussion of C. H. Bosanquet's paper.[15]

(*c*) The required height of chimney is then obtained by subtracting the plume rise, found from Fig. 4, from the required height of plume found from Fig. 3.

(*d*) The foregoing assumes that the plant is situated on fairly level terrain

**Table 7. Summarized Data of Worked Examples of Chimney Height, $SO_2$ Concentration and Dust-deposition Rate**

| | | | Proposal I | Proposal II |
|---|---|---|---|---|
| GIVEN DATA | M.C.R. of boiler plant | 80,000 lb./h. | 4 chimneys | 2 chimneys |
| | Coal fired by chain grate | | | |
| | Dust emitted with flue gas—measured at 32°F. —total | grain/ft.³ | 0·5 | 0·3 |
| | Dust emitted with flue gas—measured at 32°F. —>76 $\mu$ | grain/ft.³ | 0·01 | 0·007 |
| | Steam: coal—evaporation ratio | | 8 : 1 | |
| | Flue gas—exit temperature | —°F. | 400 | |
| | Height of boiler-house or highest adjacent building | —ft. | 52 | |
| | Type of district | | Average | |
| | $SO_2$—allowable max. g.l.c. | —pphm | 50 (see Table 3) | |
| | Sulphur content of coal (by weight) | —per cent | 1·5 | |
| | Wind speed | —ft./sec. | 16 | |
| | Velocity of discharge from chimney | —ft./sec. | 30 | |
| | Dust grading | | See Table 8 | |
| | Dust-deposition rate allowable for constant wind direction—g/100m².mth. within an octant | | 1,000 (see Section **12·1**) | |
| | **$SO_2$ CALCULATIONS** | | | |
| (1) | Height of plume to give specified g.l.c. of $SO_2$—from Fig. 3 | —ft. | 115 | 115 |
| (2) | Plume rise—from Fig. 4 | —ft. | 39 | 60 |
| (3A) | Calculated height of chimneys to give specified $SO_2$ max. g.l.c. | —ft. | 76 | 55 |
| | For a plant of this size the $2\frac{1}{2}$ times rule must be applied; consequently, the chimney heights should be 130 ft. | | | |
| (3B) | The effective plume height is then | —ft. | 169 | 190 |
| (4A) | Maximum g.l.c. of $SO_2$ from 130 ft. chimneys | —pphm | 25 (satisfactory) | 20 (satisfactory) |
| (4B) | Distance of max. g.l.c. of $SO_2$ from 130 ft. chimneys—calculated from (3B) and eqn. (7) | —ft. | 1,560 | 1,780 |
| | **DUST CALCULATIONS** | | | |
| | Maximum dust-deposition rate for constant wind direction: | | | |
| (5A) | With chimney height calculated for specified $SO_2$ concentration—(see 3A) | —g/100 m².month | 2,530* at 460ft | 2,530* at 460 ft |
| (5B) | With chimneys of recommended height—(see 3B) | —g/100 m².month | 1,170* at 680ft | 550 at 760 ft |
| (5C) | *With one chimney only of recommended height* | —g/100 m².month | *680* at *890 ft* | *410* at *890 ft* |

* Above specified dust-deposit rate

and some correction must be made if it is not. The distance from the chimney at which the patches of maximum gas concentration occur at ground level is given by equation (7) and is 9–11 plume heights; this distance is calculated from the Bosanquet and Sutton equations and is subject to more uncertainty than the maximum g.l.c.[13,14] It follows that if the ground at 10–15 plume heights from the chimney is somewhat higher than the ground at the base of the chimney, most of the difference in height should be added to the height of the chimney. If the ground rises steeply, advice should be sought from D.S.I.R., Warren Spring Laboratory.

### 17.4. Summary of Worked Examples

Table 7 summarizes worked examples for a medium-size boiler plant with two or four chimneys and two efficiencies of dedusting.

## 18. Calculation of the Height of Chimney Required to give a Specified Rate of Dust Deposition

### 18.1. General

The problem of determining the height of chimney required to limit the maximum rate of deposition of grit and dust is solved stepwise because of the necessity for calculating the deposition rate of each size grade of dust in the gas stream leaving the chimney. Consequently, calculation is first made of the rate of dust deposition from a chimney of the height required to give the specified maximum g.l.c. of $SO_2$ or to $2\frac{1}{2}$ times rule, whichever is the higher, using the concentration and size-grading of the dust expected to leave the dust arrestor at maximum continuous rating of the furnaces. The performances assumed for the dust arrestor should be the expected normal operating average, which will not necessarily be as good as that obtained under test conditions. If the trial calculation indicates that the rate of dust deposition is greater than that recommended in Section **12**, the design engineer should then decide whether it is cheaper to build a higher chimney or to install a dust arrestor of better performance, particularly with respect to dust particles greater than 76 microns. The calculation is then repeated for the revised conditions.

The detailed method of calculation given below is an arrangement of the Bosanquet, Carey and Halton formula[6] designed to facilitate repetitive calculation; the author is indebted to R. M. Kelsey[42] for this method.

### 18.2. Arrangement of Size Analysis of Dust from Chimney

The size analysis of the dust is usually expressed in terms of percentage by weight less than stated sizes as in Table 8. From a large-scale graph of the size analysis, of which Fig. 5 is part, obtain the fractions by weight within the size-grade limits as in the worked example, column 3 of Table 9; these grade limits have been chosen to give even steps in the ratio $\frac{f}{u}$, *i.e.* free-falling speed to wind speed.

### 18.3. Method of Calculation of Dust Deposition from Large Boilers

(*a*) The total height to which the plume rises is the sum of the chimney height and the plume rise estimated from Fig. 4, knowing the flue-gas temperature and the gas rate per chimney.

(*b*) Table 9 is a *pro forma* calculation sheet with examples of figures entered under the headings in columns 3, 5, 7, etc. The method of use is as follows:

In column 3 insert the weight fractions *Fr* of the dust grading; see Section **18.2** and Fig. 5.

Enter in columns 5, 7, 9 the product of the weight fractions *Fr* (column 3) by the value of $\phi$ in columns 4, 6, 8, etc., ignoring insignificant values of the product as shown in column 5.

## TABLE 9.—CALCULATION SHEET FOR DUST-DEPOSITION AND COVERAGE RATES

Boiler plant—80,000 lb/h—Coal fired by chain grate  Flue-gas rate—31,700 ft³/min at 60° F  Flue-gas exit temp.—400° F; exit velocity—30 ft/sec

Wind speed—16 ft/sec, direction constant within an octant

*Proposal I* 4 chimneys, dust burden 0·5 grains/ft³ at 32° F } dust density
*Proposal II* 2 chimneys, dust burden 0·3 grains/ft³ at 32° F } $\sigma = 2$ g/cm³

| $f/u$ | Grade limits $\mu$ | Fraction in grade ($Fr$) | $(x/H)=1$ | | $(x/H)=1{\cdot}5$ | | $(x/H)=2$ | | $(x/H)=3$ | | $(x/H)=4$ | | $(x/H)=5$ | | $(x/H)=6$ | | $(x/H)=7$ | | $(x/H)=8$ | | $(x/H)=10$ | | $(x/H)=15$ | | $(x/H)=20$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $\phi$ | $\phi\times Fr$ | $\phi$ | $\phi\times Fr$ | $\phi$ | $\phi\times Fr$ | $\phi$ | $\phi\times Fr$ | $\phi$ | $\phi\times Fr$ | $\phi$ | $\phi\times Fr$ | $\phi$ | $\phi\times Fr$ | $\phi$ | $\phi\times Fr$ | $\phi$ | $\phi\times Fr$ | $\phi$ | $\phi\times Fr$ | $\phi$ | $\phi\times Fr$ | $\phi$ | $\phi\times Fr$ |
| 0·6 | >465 | | 750 | | 2,020 | | 1,010 | | 97·1 | | 9·16 | | | | | | | | | | | | | | | |
| 0·5 | 465–360 | | 206 | | 1,250 | | 1,110 | | 241 | | 40·3 | | 7·5 | | 1·65 | | 0·416 | | | | | | | | | |
| 0·4 | 360–310 | | 37·2 | | 508 | | 799 | | 391 | | 116 | | 33·8 | | 10·7 | | 3·67 | | 1·38 | | | | | | | |
| 0·35 | 310–270 | 0·0005 | 13·0 | 0·01 | 266 | 0·13 | 559 | 0·28 | 410 | 0·21 | 162 | 0·08 | 59·1 | 0·03 | 22·4 | 0·01 | 8·97 | | 3·86 | | 0·851 | | | | | |
| 0·3 | 270–240 | 0·0100 | 3·9 | — | 120 | 0·12 | 335 | 0·34 | 368 | 0·37 | 195 | 0·19 | 88·7 | 0·09 | 40·2 | 0·04 | 18·8 | 0·02 | 9·24 | 0·01 | 2·55 | | | | | |
| 0·25 | 240–200 | 0·00175 | 0·975 | — | 44·9 | 0·08 | 168 | 0·29 | 275 | 0·48 | 195 | 0·34 | 111 | 0·19 | 60·5 | 0·11 | 33·0 | 0·06 | 18·5 | 0·03 | 6·38 | 0·01 | 0·729 | | | |
| 0·2 | 200–170 | 0·0015 | 0·195 | — | 13·5 | 0·02 | 67·0 | 0·10 | 166 | 0·25 | 156 | 0·23 | 111 | 0·17 | 72·2 | 0·11 | 46·2 | 0·07 | 29·7 | 0·04 | 12·7 | 0·02 | 2·18 | | | |
| 0·15 | 170–125 | 0·00525 | | | 3·03 | 0·02 | 20·1 | 0·11 | 74·8 | 0·39 | 93·6 | 0·49 | 83·1 | 0·44 | 65·3 | 0·34 | 48·5 | 0·25 | 35·6 | 0·19 | 19·2 | 0·10 | 4·93 | 0·03 | 1·63 | 0·01 |
| 0·1 | 125–100 | 0·004 | | | 0·455 | — | 4·03 | 0·02 | 22·3 | 0·09 | 37·4 | 0·15 | 41·6 | 0·17 | 39·2 | 0·16 | 34·0 | 0·14 | 28·4 | 0·11 | 19·2 | 0·08 | 7·39 | 0·03 | 3·27 | 0·01 |
| 0·075 | 100–80 | 0·008 | | | | | 1·45 | 0·01 | 9·86 | 0·08 | 19·0 | 0·15 | 23·6 | 0·19 | 24·4 | 0·20 | 22·8 | 0·18 | 20·5 | 0·16 | 15·4 | 0·12 | 7·26 | 0·06 | 3·71 | 0·03 |
| 0·05 | 80–60 | 0·018 | | | | | 0·403 | 0·01 | 3·36 | 0·06 | 7·5 | 0·14 | 10·4 | 0·19 | 11·8 | 0·21 | 11·9 | 0·21 | 11·4 | 0·21 | 9·59 | 0·17 | 5·54 | 0·10 | 3·27 | 0·06 |
| 0·025 | 60–40 | 0·066 | | | | | 0·0718 | — | 0·736 | 0·05 | 1·88 | 0·12 | 2·93 | 0·19 | 3·63 | 0·24 | 3·97 | 0·26 | 4·05 | 0·27 | 3·82 | 0·25 | 2·70 | 0·18 | 1·84 | 0·12 |
| 0·0125 | 40–20 | 0·275 | | | | | 0·0198 | — | 0·225 | 0·06 | 0·619 | 0·17 | 1·02 | 0·28 | 1·32 | 0·36 | 1·50 | 0·41 | 1·59 | 0·44 | 1·57 | 0·43 | 1·24 | 0·34 | 0·905 | 0·25 |
| TOTAL $=\Sigma(\phi\times Fr)$ | | | | 0·01 | | 0·37 | | 1·16 | | 2·04 | | 2·06 | | 1·94 | | 1·78 | | 1·60 | | 1·46 | | 1·18 | | 0·74 | | 0·48 |
| Deposition rate g/100 m².mth — Proposal I | | | 6 | | 210 | | 658 | | 1160* | | 1170* | | 1100* | | 1010* | | 908 | | 829 | | 670 | | 420 | | 272 | |
| Deposition rate g/100 m².mth — Proposal II | | | 3 | | 100 | | 313 | | 550 | | 550 | | 523 | | 480 | | 431 | | 393 | | 318 | | 199 | | 129 | |

* Above specified limit

*Daily coverage of ground expressed as a percentage (suggested limit—below 0·04 per cent)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Due to dust size > 20 $\mu$ — Proposal I | 0 | 0·02 | 0·08 | 0·20 | 0·29 | 0·35 | 0·38 | 0·39 | 0·39 | 0·35 | 0·25 | 0·17 |
| Due to dust size > 20 $\mu$ — Proposal II | 0 | 0·01 | 0·04 | 0·09 | 0·14 | 0·17 | 0·18 | 0·19 | 0·19 | 0·17 | 0·12 | 0·08 |

| | | | |
|---|---|---|---|
| Due to dust size < 20 $\mu$ | Proposal I | 0·07 | |
| | Proposal II | 0·03 | |
| Total daily coverage at about 10 plume heights | Proposal I | 0·42% | 4 chimneys with 0·5 gr/ft³ |
| | Proposal II | 0·20% | 2 chimneys with 0·3 gr/ft³ |

**Table 8. Grading of Dust in Worked Example, Table 9**

| *Grade size microns* | *Percentage less than stated size* |
|---|---|
| 295 | 100 |
| 210 | 99·7 |
| 150 | 99·4 |
| 104 | 98·7 |
| 76 | 97·7 |
| 60 | 96·0 |
| 40 | 89·4 |
| 30 | 77·9 |
| 20 | 61·9 |
| 10 } Data used for | |
| 5 } coverage and | 40·3 |
| $2\frac{1}{2}$ } visibility | 20·5 |
| calculations only | 10·5 |

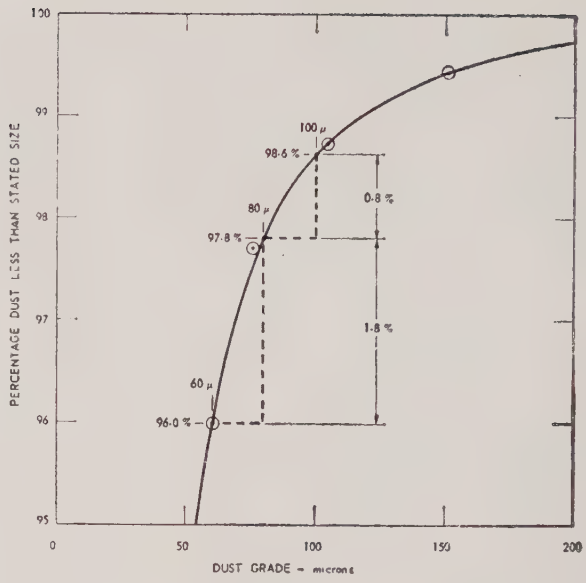



*Fig. 5. Part of graph showing relationship of weight of dust to size limits for sample collected from chain-grate plant*

(*c*) Multiply the summation of columns 5, 7, 9, etc., by $1{\cdot}1\ W/H^2 \times 10^3$ (where $W$ is given by the gas rate in ft.³/min. and dust concentration in grains/ft.³, both measured at the same temperature) to obtain the rate of dust deposit in g/100 m².month at each distance $x/H$ plume heights (with wind direction constant within an octant).

(*d*) Table 7 shows summarized results of dust calculations for two boiler-plant schemes.

### 18.4. Rate of Deposition at Specific Points Downwind of the Chimney

The rate of deposition of dust at points downwind under the centre line of the plume may be obtained from a graph of the results calculated by the method of Table 9.

### 18.5. Correction for Other Wind Speeds and Dust Densities

Column 1 of Table 9 gives the ratio $\left(\frac{f}{u}\right)$ where $f$ is the average free-falling speed of the size range of particles given in column 2 and $u$ is the wind speed. In Table 9, values assumed in the calculation are wind speed 16 ft./sec. and particle density 2 g/cm.³

For other wind speeds and/or particle densities, the particle size range limits in column 2 of Table 9 must be multiplied by a factor

$$\sqrt{\frac{u'}{16} \times \frac{2}{\sigma'}}$$ where $u'$ is the new wind speed in ft./sec. and $\sigma'$ is the new particle density in g/cm.³

The ratio for $\frac{f}{u}$ in column 1 and values of $\phi$ in columns 4, 6, 8, etc., are directly related and remain constant irrespective of wind speed or particle density.

Thus with a cold process effluent, emitted from a 60-ft. chimney, there would be no appreciable plume rise and the effective plume height would be the chimney height, *i.e.* 60 ft. At this height the most frequent wind speed would be about 8 ft./sec. With a particle density of 5 g/cm³, the above correction factor becomes:

$$\sqrt{\frac{8}{16} \times \frac{2}{5}} = 0{\cdot}447.$$

Thus, all the particle-grade limits given in column 2 of Table 9 must be multiplied by 0·447, *e.g.* grade limits 200–170 microns would be changed to 90–76 microns. From a graph showing

the grading of the emitted process dust, the fractions between these new limits are determined in exactly the same manner as for the boiler dust example (see Section **18.2**) and thereafter the deposition rates are calculated, neglecting deposition of particles having a free-falling speed less than 0·1 ft./sec. (compare Section **13**).

### 19. Worked Example on Plume Visibility

It is convenient to consider the emission from one chimney of the plant in Proposal II of Table 7. The size grading of the emitted dust is given in Table 8. The gas rate from the chimney is then 16,000 ft.$^3$/min. and the height of the chimney is 130 ft. It is required to know the appearance of the plume after it has travelled a horizontal distance of three chimney heights.

Using equation (4) given in Section **14**, we find that $B = 0{\cdot}8$ per cent. It may also be deduced from equation (4) that the plume becomes substantially invisible (*i.e.* 2·5 per cent. light absorption) after travelling 120 ft. Hence the plume should be acceptable.

### REFERENCES

*(These extracts from the complete list of references are those mentioned in Appendix 1 above).*


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# WARREN SPRING LABORATORY

The Warren Spring Laboratory Report for 1959 (pp. 27, H.M. Stationery Office) shows that the new organization has settled down in its modern home and that its many activities are proceeding apace. Air pollution is of course only one of the sections of the Laboratory, but the report admits that most of the publicity organized during the year has been concerned with the work on air pollution. This has included research or investigations on the emission of smoke from ships in coastal waters, acid smuts from the combustion of fuel oil, the removal of sulphur oxides from flue gas, pollution from motor vehicle exhaust gas, the dispersal of exhaust gas, and of course the measurement of air pollution. A further investigation, made at the request of the Alkali Inspectorate, is on the rate of deposition of soluble fluorine compounds in two areas subject to fluorosis and in one where there is no known major source of fluorine. Preliminary results show less difference between this latter area and the other two than might have been expected.

Another important research is on the oxides of nitrogen which, known to be emitted by nearly all fuel-burning appliances, may be significant factors in air pollution. It is, for example, possible that nitrogen peroxide may influence the oxidation of sulphur dioxide in the atmosphere and lead to the formation of sulphuric acid mist. Measurements made during fogs showed that there was a tendency for the nitric oxide to increase considerably and the nitrogen peroxide only slightly. This preliminary observation, which is consistent with a relatively greater interaction between nitrogen peroxide and sulphur dioxide during fogs, may be important in leading to a better understanding of the toxicity of polluted air at such times.

# National Coal Board

## Report for 1959

**Report and Accounts for 1959, H.M. Stationery Office, 9s. net.**

THE Board's main task during the year under review, as in the previous year, was to regulate output to conform to a falling consumption without undue harm to the future productive capacity of the industry, without too great loss of revenue and with the minimum harm to the mining community.

The estimated consumption in 1960 is 196 million tons including exports, and to avoid stocking, maximum output is planned at 195 million tons including 7 million tons of opencast coal. In the " Revised Plan for Coal " it is estimated that in 1965, the demand including exports would be between 200 and 215 million tons.

The output of coal during 1959 was 206·1 million tons of which 195·3 million tons was deep-mined and 10·8 million tons opencast, a reduction of 9·7 million tons on the previous year. 53 collieries were closed during the year; but by careful control of recruitment and redeployment, 1,700 men only were left without employment at the end of the year. The cut in opencast production from 14·3 to 10·8 million tons resulted in a heavy loss of profit but has lessened the effect of the fall in the demand on the deep mines.

Although power stations sent out 7 per cent. more electricity during the year, they used less coal owing to the greater use of oil. In the gas industry, production was 2·7 per cent. less, but 9 per cent. less coal was carbonized owing to the more extensive use of oil and refinery gas. Oil consumption in general industry increased by the equivalent of 2·5 million tons of coal.

At the end of the year, undistributed stocks of coal amounted to 36 million tons. Care has been taken to minimize degradation of coal in stock.

In order to meet competition from other fuels, the Board has organized a staff to give after sales service to coal consumers.

### The Clean Air Act

Although, states the Report, modern industrial appliances burning coal are just as smokeless in operation as oil burning appliances, coal has lost ground to oil because of the misguided idea that with coal it is more difficult to comply with the Clean Air Act. " Following representations from the Board an order under Section 11(4) of the Clean Air Act was made by the Minister of Housing and Local Government in July 1959. The Order gives general exemption to those coal burning appliances (other than those using pulverized fuel) fired by mechanical stokers and installed since December 31st, 1956. This change has since been made effective in Scotland also. The Minister also asked local authorities to give individual exemptions to coal burning appliances installed before December 31st, 1956, where these are capable of working as smokelessly as those exempted by the Order, and reminded local authorities that pulverized fuel furnaces are capable of almost smokeless operation."

### Development and Testing of Appliances

The Board collaborates closely with appliances manufacturers in the development of more efficient coal-burning appliances. The British Coal Utilisation Research Association, to which the Board contributes, is developing automatic controls for industrial shell boilers. The same organization has also evolved a miniature chain-grate stoker to use small coal in central heating plants, and a prototype has worked successfully in a London block

of flats. The Board and the Gas Council have taken over the responsibility for testing domestic solid fuel grates and stoves.

**Exports**

Exports and bunker shipments amounted to 4·3 million tons, about a half million tons less than in 1958.

**Production**

The productivity at 751 manshifts of all workers per thousand tons was the highest ever attained. Of the deep-mined output of 195·3 million tons, 2·7 million tons was from licensed mines of which there were 536 at the end of the year.

The Board's labour force was reduced by over 47,000 men, largely by allowing wastage to outrun recruitment. Absence rates from all causes were the highest since vesting date, 14·69 per cent. compared with 14·14 per cent. in 1958. The amount of coal lost through unofficial strikes and restrictions was 973,000 tons, the lowest since 1950.

The increase in efficiency of production was achieved by concentration in new and reconstructed pits and closure of older and inefficient pits and by increased efficiency in cutting and loading at the coal face. The amount of coal loaded mechanically was 72·6 million tons, 7 million tons more than in 1958 and 32 per cent. of the whole output. The number of full or partial installations of self-advancing roof supports rose from 35 to 75 during the year.

**Coal Preparation**

During the year 24 new coal preparation plants with a capacity of 13 million tons came into use, and 54 additional plants with a capacity of 40 million tons a year are in preparation. Since 1947, 273 plants costing £60 million have been built, and 135 froth flotation units for cleaning fine coal have been put into operation.

**Large Coal**

The proportion of large coal fell slightly during the year. The Board has attempted to arrest the decline in the proportion of large coal by paying attention to shot firing, coal-cutting and transport practice. Over 40 sets of compressed-air blasting plants were introduced bringing the total number of sets in use to 84.

**Brickworks**

The Board is the second largest producer of bricks in the United Kingdom, and during the year produced 485 million bricks, all of which together with 20 million in stock at the beginning of the year were disposed of. Brickworks made a profit of £427,533.

Since vesting day 278 schemes of reconstruction and new collieries had been approved at a cost of £618 million. Of these 127 have been substantially completed.

Off-shore borings for proving reserves have been continued off the Durham coast. A new method of underwater geophysical exploration, basically similar to marine echo-soundings, has been used. Research has also been carried out in the Firth of Forth and on the Cumberland coast.

**Coke**

During the year, the Board's coking plants produced 6,249,000 tons of coke and breeze. 367,000 tons of crude tar, 26 million gallons of crude benzole, 65,000 tons of sulphate of ammonia, 15,000 tons of other ammonia products and 55,000 million cubic feet of gas. The "Phurnacite" plant produced 645,000 tons of "Phurnacite" and 27,000 tons of crude tar. This plant is being extended. 167,000 tons of "Warmco" was produced.

Because of long term contracts to supply gas to Area Gas Boards, and the expense of working coke ovens at less than full capacity, it was not possible to restrict coke production in 1959 to match demand, and stocks accumulated, approaching 5 million tons by the end of the year. The better trend in demand for blast furnace and foundry coke should mean no material addition to stocks in 1960, and indeed some stocks may be lifted.

The efforts of the Research Estab-

lishment have been directed to the production of high-grade smokeless fuels from low-cast non-coking coals. Two processes have reached pilot scale development and two plants have been erected.

A Ruhrgas slagging gasifier for making low-grade producer gas from low-grade coal has been installed at Manvers Main for underfiring coke ovens. The Board is also co-operating with the West Midlands Gas Board in the supplies of non-coking coal to the Coleshill Lurgi gasification plant, expected to utilize 420,000 tons of coal a year.

The Board has reached the conclusion that underground gasification of coal is not a commercial proposition in this country.

The Board's operating profit for the year amounted to £13·1 million; but after meeting interest charges of £36·8 million to the Minister of Power and £0·3 million for other interest, the deficiency for the year was £24 million.

Capital expenditure during the year amounted to £112 million, an increase of £8 million on the previous year, bringing the total expenditure on capital account since vesting date to £877 million.

# THE CLEAN AIR COUNCIL

There have been a number of changes in membership of the Clean Air Council, the Minister of Housing and Local Government's advisory council set up under the provisions of the Clean Air Act. Members of the Society will be pleased to note that Mr. Stanley E. Cohen, Hon. Treasurer of the Society, and Chairman of the Health Committee, Corporation of London, is among the new members. It is understood that, after a period for the transition, membership of the Council will be for three years, with a third of the members retiring each year.

The present membership is as follows:

J. L. Lewis (Unfloc Ltd.), W. K. Hutchinson (Gas Council), L. Eastwood (C.P.H.J., Rotherham), P. B. Dingle (Town Clerk, Manchester), Dr. W. A. Macfarlane (National Industrial Fuel Efficiency Service), R. S. MacTier (Alfred Holt & Co.), Dr. S. W. Saunders (I.C.I. (Heavy Organic Chemicals) Ltd.), Dr. R. C. M. Pearson, M.O.H. (Newcastle-upon-Tyne), Councillor J. A. Brown (Middlesborough), C. N. Vignoles (Shell Mex), Professor M. W. Thring (Dept. Fuel Technology, Sheffield University), K. W. C. Grand (British Transport Commission), Dr. Llywelyn Roberts (M.O.H., Sheffield), Alderman Mrs. R. F. Isley (Wolverhampton), Councillor Mrs. P. M. Mainwaring (Port Talbot), Sir John Charrington (Charrington, Gardner and Locket Ltd.), Stanley E. Cohen (City of London), Councillor F. V. Magness (Willenhall), Mrs. D. M. Charlton (Womens Advisory Council on Solid Fuel), A. G. Dawtrey (Town Clerk, Westminster), Alderman C. A. Bence (Cardiff), Sir Josiah Eccles (Electricity Council), Commander C. Buist (Coalite & Chemical Products Ltd.), Sir Hugh Beaver, Lt.-Col. the Lord Dudley Gordon, A. H. Wilson (Courtaulds Ltd.), S. Jones (Past President, N.U.M.).

It should be noted that industrial representatives and officers and members of local authorities may have been nominated by an association and are not representing only the firm or authority mentioned for reference.

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**Combustion Engineering Association**

The C.E.A. announces that its conference this year will be held at the Hotel Majestic, Harrogate, on Tuesday and Wednesday, October 8th and 9th. The theme of the conference will be " Getting the Best out of Coal," and will embrace boiler plant and industrial furnaces and kilns. Details can be obtained from the Association at 70 Jermyn Street, London, S.W.1.

# SMOKELESS USE OF LOW-GRADE COALS IN SMALL BOILER PLANT N.C.B. INSTALLATION

The plant at the Central Engineering Establishment of the National Coal Board at Stanhope Bretby, was installed primarily to provide steam for space heating the works and offices, and to provide a small amount of steam for process in the canteen, etc.

It was also intended that the plant should be used as an example for other National Coal Board installations where there were to be similar steam demands, for example in electrified collieries, or Area Central Workshops, etc. It was also the intention for the plant to provide an opportunity for trying out under actual working conditions new ideas which may be later used generally within the Board.

An inspection of the plant will show that clean, efficient and economical operation is not impossible when burning the lower grades of unwashed small coals, even on a small boiler plant.

These standards of operation are shown to be possible with operators of average intelligence, and without any special effort on the part of management. The only requirements are routine control by an interested engineer, and the use by staff of the instruments provided.

The steam cost represents a low figure for this size of plant, and would compare favourably with oil or gas firing. The plant also indicates clearly that the requirements of the Clean Air Act can be easily and economically met even when burning unwashed small coals. The only provisions are that the coal is maintained in a consistent condition by the boiler operational staff, and is fired with an average degree of skill on the mechanical firing equipment, and also that the plant is equipped with simple and cheap grit catching equipment.

**General Description of the Plant**

*The boilers*: 2 Adamson Double Pass Economic boilers each rated at 5,500 lbs./hr.; 1 Edwin Danks Double Pass Economic boiler rated at 11,500 lbs./hr.; All boilers designed to operate at 100 lbs./sq. in.; All boilers are fitted with: Oldbury Chain Grate stokers, Oldbury Ash extractor, Separate Chimney Stacks, Separate I.D. Fans equipped with shunt suction type or scroll type grit arrestors, incorporating secondary centrifugal collectors which reduce the grit emission to an acceptable degree.

The coal is mechanically handled throughout, and incorporates means for water conditioning of the fuel.

The bunkers and chutes on the larger boiler are glass lined to obviate any hold up of the flow of coal to the boilers.

All boilers are fed with base-exchange softened water, and the water level in each of them is automatically controlled.

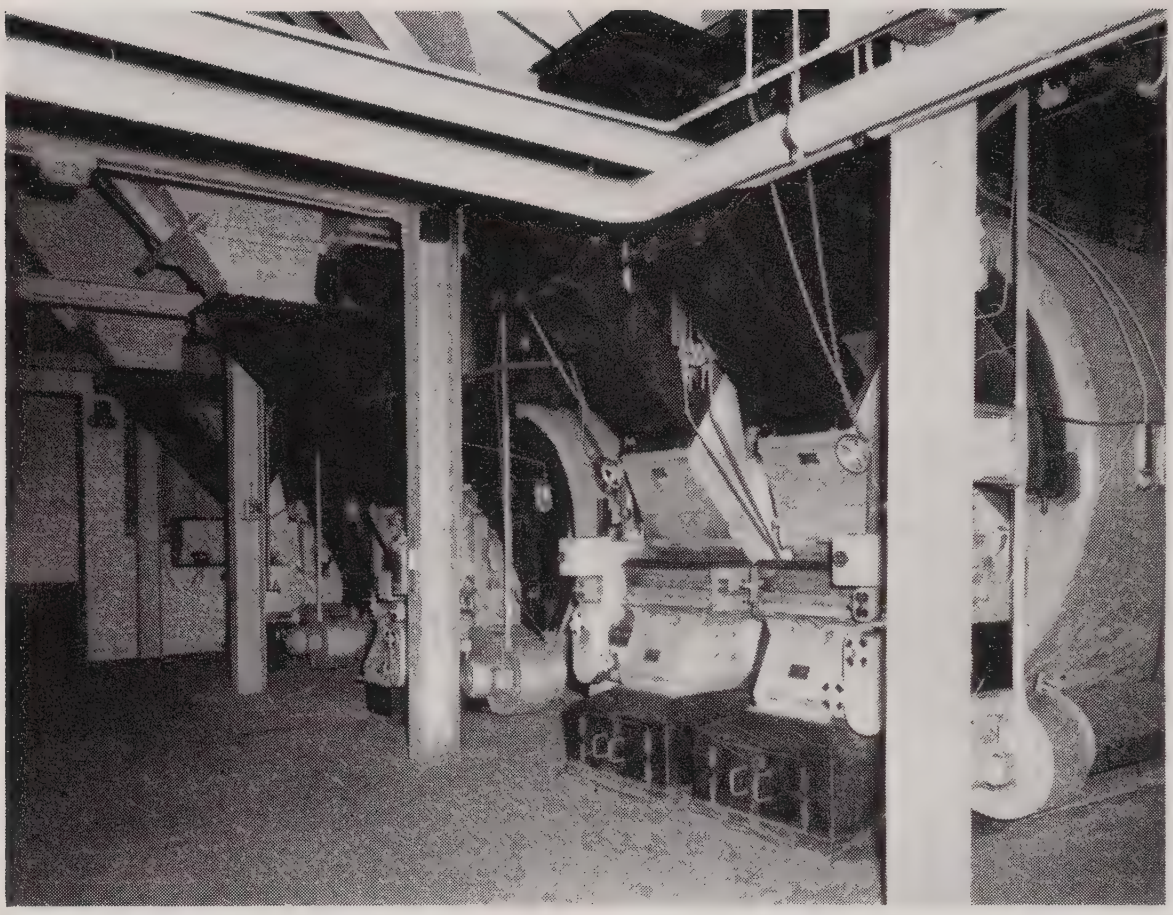
The plant is provided with an instrument panel which incorporates a water meter, temperature recorders for flue gases and water, per cent. $CO_2$ recorders, steam pressure recorders and indicating draught gauges.

All the coal to the plant is weighed on a conveyor weigher, and all electric power is also metered separately.

*Boiler fuel used:* When the boiler plant at C.E.E. was designed it was decided that the lowest grade of fuel practicable should be burned. The fuel used is Donisthorpe $\frac{1}{2}$ in. unwashed slack having a calorific value of about 10,000 B.t.u.s/lb. and costing about 68s. per ton.

*Operational data:* The average operating efficiency on the smaller boilers is approximately 70 per cent. and on the larger unit about 80 per cent.

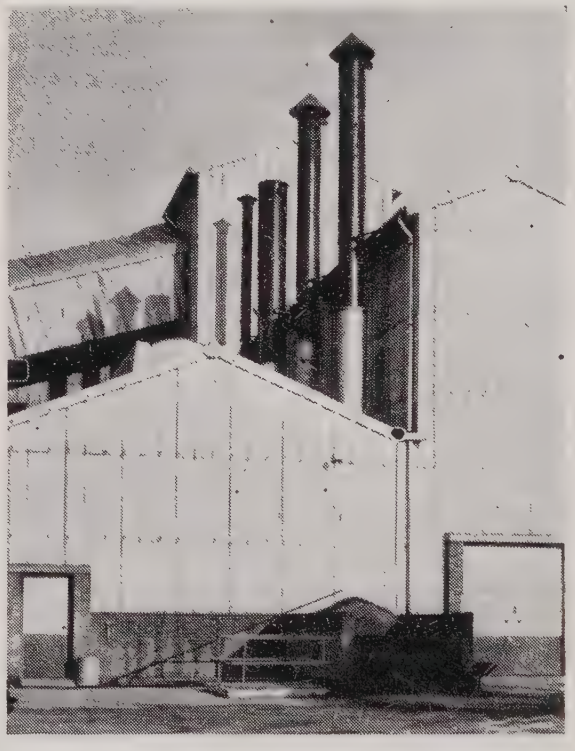
The average steam costs on a monthly basis including fuel, labour and electrical power is 6s. 10d. per 1,000 lbs.



*General view of the Boiler House showing: Nos.* 1 *and* 2 *Boilers*, 5,500 *Adamson Economic, No.* 3 *Boiler*, 11,500 *Danks Economic* (*off for cleaning*)



*Incoming Inclined Conveyor. Testing coal for dryness, and adding moisture with main spray and subsidiary spray. Photo also shows the continuous weigher, and beyond that the magnetic separator*



*Exterior of the Boiler House. The two stacks nearest the camera are in operation, and show clearly that there is no sign of smoke or grit*



*Interior of No. 3 Bunker showing glass lining and details of design, e.g., all inclined surfaces*



*View of a flue baffle fitted in No. 3 Boiler. Behind the baffle can be seen the brickwork of the bridge*

There is no smoke emission whatsoever, and measurements of grit emission have shown it to be 0·1 grains per cu. ft. at N.T.P. which represents a very low emission, and will certainly come within the requirements of the Clean Air Act.

**Special Features**

*Water Conditioning:* The coal as received is in a relatively dry and dusty condition, and in this state is not suitable for efficient burning. It has been found that the addition of a controlled amount of moisture (sufficient to make the coal "ball" when held tightly in the hand) greatly increases the efficiency of burning, and also reduces the grit emission.

The conditioning unit incorporates a series of water sprays placed over the incoming conveyor, and a vertical mixing device, known as the C.E.E. mixer, which mixes the coal intimately as it flows through it. By these means the coal is maintained in a consistently wetted condition, as it is fed to the main fuel bunkers.

*Glass Lining:* The purpose of the glass lining in the bottoms of the bunkers and in the feeding chutes is to obviate the danger of the wetted coal sticking, and so to ensure a steady flow to the chain grate stoker hoppers.



*Underside view of No. 3 Bunker, which is glass lined, and the delivery chutes to No. 3 Boiler, which are also glass lined*

*Furnace Tube Baffles:* Refractory baffles have been recently fitted to the furnace tubes, and have resulted in an increase in efficiency and a further reduction in the already small grit emission.

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**Kerosene Firelighter**

The report in our last issue of electric firelighters aroused much interest, particularly in view of the discussions that have led to the Minister's "Sticks and Paper" circular. It is now reported that a kerosene firelighter, using a small electric fan and producing a blow-lamp type of flame, has been developed at the Department of Fuel Technology, University of Sheffield, and that it should soon be on the market. The idea for such a device came from the Clean Air Council for Scotland because many districts in Scotland have no gas.

# Obtaining Gas From Low-Grade Coal

*New Process to be Tested*

The economics of a new complete gasification process for obtaining gas from low grade coal are to be investigated at a pilot plant which is to be built at the North Thames Gas Board's works at Bromley, East London. The pilot plant will be operated as an experimental unit by the London Research Station of the Gas Council and its capital cost will be approximately £225,000. It is expected to produce about two million cu. ft. of blue water gas per day.

The contract for its construction has been placed with Simon-Carves Limited, who are working in conjunction with Dr. C. Otto and Company of Bochum, West Germany. Work has already started, and will be completed in about a year.

**Cheap 'Lean' Gas Needed**

The decision to build this plant has arisen from the need for a process which will gasify the cheapest grades of coal completely, producing blue water gas on a large scale at the lowest possible cost. The intention is that this cheap blue water gas would be mixed with a cheap rich gas—such as imported methane, gas obtained from oil gasification, or tail gases from refineries—to provide towns gas at the statutory calorific value. This has become necessary because it is now more expensive to manufacture 'lean,' or low-calorific, gas in existing conventional plants than it is to produce rich, or high-calorific, gas. It is essential, however, to have supplies of 'lean' gas in order to reduce the calorific value of rich gases to a standard level.

Interest in complete gasification of coal has also arisen because of the shortage of the conventional coking coals which the gas industry has always used in the past; as a result, there is the prospect of a coming shortage of the good quality coke which is used to manufacture blue water gas in conventional plant. Because of this prospect, work was started in the Gas Council's London Research Station 10 years ago to find new methods of producing blue water gas. A comprehensive survey of all known methods, and methods which were only in the early development stage, was carried out. The result of this survey was that attention was focused on a process known as the slag bath generator which has been developed in Germany from an invention by Herr Roman Rummel of the Union Kraftstoff A.G.

**Powdered Coal**

This process involves forcing powdered coal, together with air or oxygen and steam, into a bed of molten slag, which produces blue water gas continuously. This process in a somewhat different form has been operated on a large scale in Germany, using brown coal as a fuel. In this country, where there are no considerable quantities of brown coal, modifications have been made, and the pilot plant will utilise powdered low-rank black coal as a fuel, and use air instead of oxygen in the processing. Because of this use of air instead of oxygen, the slag bath generator which it is proposed using in the pilot plant at Bromley will consist of a twin shaft system and a divided slag bath in one part of which coal is burned in air with combustion products escaping up one of the shafts. In the other part coal will react with steam in the presence of molten slag, heated by the combustion in the first half of the bath, to produce blue water gas. The molten slag will be kept circulating under a dividing curtain so that heat generated on the combustion side is carried into the gas-making side to provide the heat required in the process.

This is a complete gasification process, there being no by-products except slag.

# THE G.A.P. FURNACE UNIT

The illustration below shows the principles of the G.A.P. Unit with which coke and other smokeless fuels can be used with high efficiency and marked labour saving. It is suitable for boilers for the central heating of buildings, hot water supply and similar duties, mainly in the range 200,000 to around one million B.T.U. per hour. Most sectional boilers can be converted despite their age.

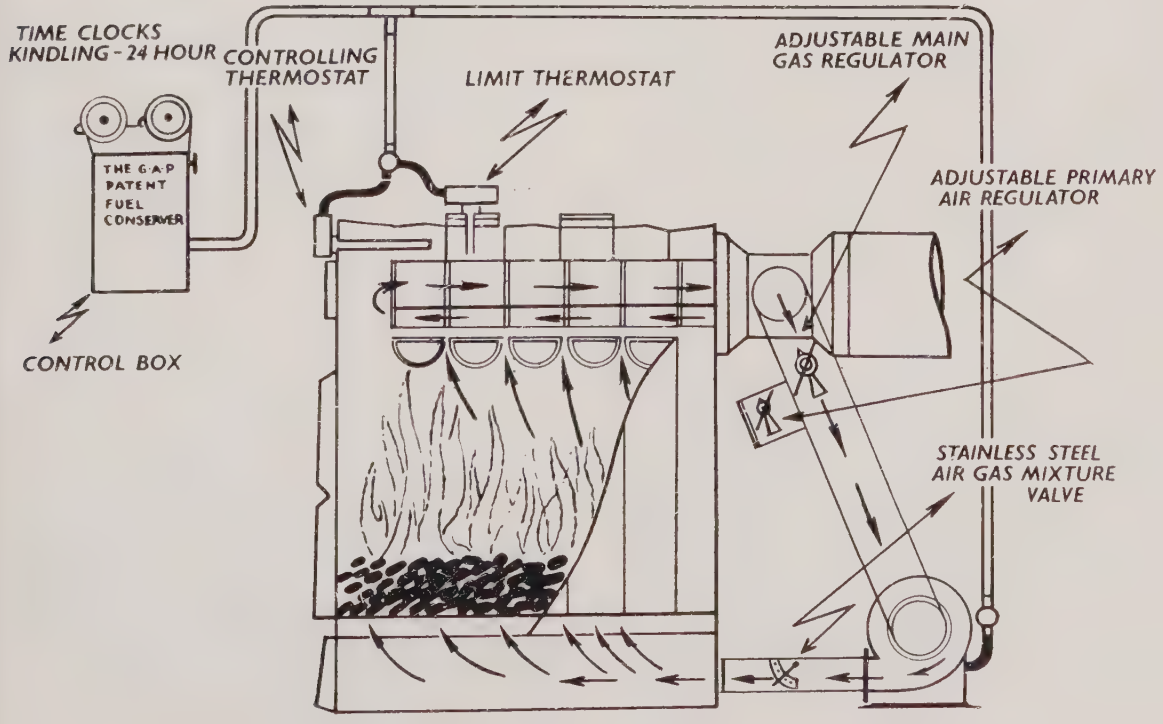
The distinctive feature is that the exhaust flue gases are extracted and mixed with a pre-determined proportion of prime air, which in turn is blown back to the base of the furnace under fully automatic control thermostats and kindling clocks.

The thermostatic control ensures substantial fuel savings, and the kindling clock, set to waken a banked fire at any time required, enables labour savings to be effected. Small gas or hard coke, or small Rexco ($\frac{3}{8}$ to $\frac{3}{4}$ in.) is recommended, and it is pointed out that breeze may be up to 40s. per ton cheaper than large coke of the same calorific value. It is claimed that clinker formation is eliminated—none at all being formed in several 24 hour tests carried out by N.I.F.E.S.

In many buildings the boiler is the part-time responsibility of a caretaker or someone else with other duties. With the ordinary section boiler frequent attention is required to maintain heating and (especially in hotels) hot water. Even under winter conditions it has been found that boilers fitted with the G.A.P. unit have run for 24 hours between bankings. And, to quote the makers, "units recently fitted to large multi-boiler installations have proved that instead of maintaining a 24 hours watch, it is now possible to run two boilers of more than one million B.T.U.s each, with one boilerman working between the hours of 8 a.m. and 5 p.m., and only one hour of that period is required of his attention —the rest of the time can be spent by the boilerman in carrying out his usual caretaker's duties. Other recent tests on sectional boilers of a capacity in the region of 300,000 B.T.U.s, which are used to provide constant hot water throughout the year, have shown that they will run for periods of up to four days without re-stoking or cleaning . . . This has been achieved by the use of kindling clocks only.

On efficiency, N.I.F.E.S. test reports are quoted as giving average figures as follows: $CO_2$, 15 to 17 per cent.; CO, 0·5 per cent. during the first half hour, nil thereafter. Flue temperature during full load, 670°F. at smoke hood. Boiler efficiencies on different types of boilers between 77 and 84·1 per cent.

Details can be obtained from G.A.P. Fuel Conservation Ltd., 6 Clement Place, Sheffield, 10.



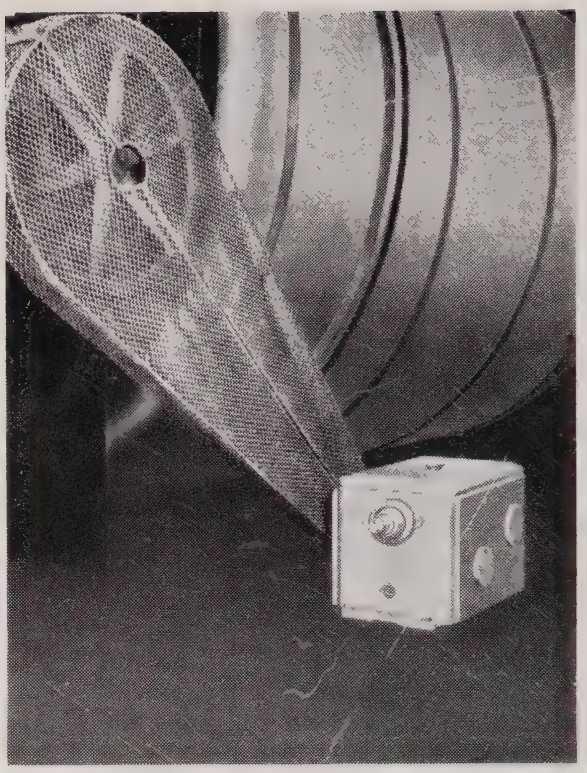
# THE "CONTORQ" UNIT

This new unit for variable speed transmission has recently been demonstrated in London. It has many diverse applications, but of interest to this journal is its possible applications to the control of automatic stoking and perhaps other functions in combustion and fuel handling. The unit is said to be revolutionary because it is completely positive, is based on sound mechanical principles and has a complete absence of fluid, or friction properties. It will maintain accurately the selected speed regardless of changes in temperature, humidity or atmospheric conditions.

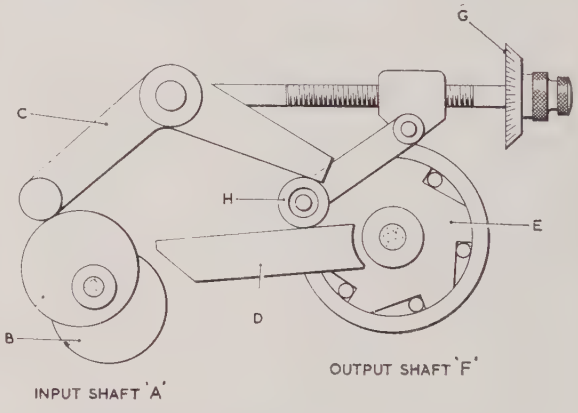
The standard unit operates from a constant input speed of 450 r.p.m., which gives an infinitely variable speed range on the output shaft of 0—50 r.p.m. Speed changes are made by the turn of a graduated dial, and speed changes may be effected whilst the unit is in operation or at rest. Remote control by servo or push buttons can be provided.

The principle employed is an ingenious arrangement of cams and levers

The following description explains the diagram: Two single lobe cams ' B ' are secured to the input shaft, the cam lobes being fixed at 180° to each other. Rotation of the cams imparts an oscillating movement to two levers ' C ' which, in turn, oscillate two levers ' D,' each of which is in contact with a roller type free-wheel mechanism ' E ' attached to the output shaft ' F.' Adjustment of the control knob ' C ' moves roller ' H ' which is interposed between the levers ' C ' and ' D,' thereby varying the angular movement of the two levers ' D ' from zero to a maximum. The angular arrangement of the cam lobes imparts a continuous motion to the output shaft, *i.e.*, as one free wheel is driving the other is returning to its starting position.



*One application of the CONtorq unit. Below, diagram illustrating principle*




The CONtorq is manufactured by Fairbairn Lawson Combe Barbour Ltd., Leeds, 1.

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**Smoke and Dust Prevention at Smokeless Fuel Plant**

The National Carbonizing Company Ltd., manufacturers of " Rexco " have installed a specially designed smoke and dust extraction plant at its Edwinstowe, Derbyshire works. The plant, the Holmes-Schneible multi-wash system was designed and installed by W. C. Holmes & Company Ltd., to the order of the main contractor, Newton, Chambers and Company Ltd. The dust plant was installed following extensions to the low-temperature carbonization plant to double the production of " Rexco." The plant now comprises 14 retorts, each of 34 tons of coal capacity.

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**International Journal Change**

It is announced that as from September the *International Journal of Air Pollution*, published by the Pergamon Press Ltd., will be concerned also with water pollution and will therefore be known as the *International Journal of Air and Water Pollution.*

# AIR POLLUTION ABSTRACTS

**451. Estimation of Ground Level Concentration from an Elevated Source, The.** Meade, P. J. (Int. J. Air Poll. **2**, 303-308, June 1960). Sutton's equations for calculating ground level concentrations of gases or dusts of negligible fall speed due to an elevated source are put into a convenient non-dimensional form. This is done by incorporating in the equations the maximum value of the concentration and the distance along the axis of the plume where this maximum occurs. It is then shown how for each value of the stability parameter, n, a single curve gives the distribution of concentration along the axis and a single diagram gives the distribution of concentration over the whole area downwind of the source, for any values of the remaining parameters in Sutton's equations. The use of the curve and the diagram will avoid the necessity of lengthy computations involving exponential factors and alternative values of several parameters.

**452. Carbon-14 Content of Urban Airborne Particulate Matter, The.** Lodge, J. P. et al. (Int. J. Air Poll. **2**, 309-312, June 1960). Very large samples of atmospheric particulate matter were collected in the central part of St. Louis, Missouri and Los Angeles, California. The carbon-14 content of various fractions of the samples was determined, and was interpreted in terms of the relative contribution of fossil fuels and contemporaneous sources of carbon to the particulate pollution of the area. It can be shown by this method, for example, that substantially all of the aliphatic hydrocarbons in the samples are of fossil origin, while about one-fourth of the oxygenated materials are derived from living matter. The general applicability of the method is discussed.

**453. Toxicological Interactions of Mixtures of Air Pollutants: Review of Recent Developments.** Stokinger, H. E. (Int. J. Air Poll. **2**, 313-326, June 1960). Recent developments are reviewed of laboratory research, stimulated by the Donora disaster a decade ago and more recently by the critical smog situation in Los Angeles, that has resulted in new findings and concepts of the interaction of certain components in both reducing and oxidizing smogs. In reducing smog in which $SO_2$ plays a dominant role, interaction with solid aerosols appears to go far in explaining the abnormal and unpredictable responses at Donora. Based on this and related work, a physicochemical theory has been developed that appears to offer a satisfactory explanation for most of these reactions.

On the other hand, physiologic mechanisms appear to govern interaction of those components of oxidant smog thus far studied. Three areas have been investigated:

(1) Tolerance and cross-tolerance among oxidant air pollutants.

(2) Protection by oil mists against ozone and nitrogen dioxide, and

(3) Antagonism of a variety of sulphur compounds for these oxidants.

Although each is a protective mechanism, all are believed to proceed by different physiologic pathways.

The nature and degree of protection is presented for each type of action, as well as hypothesis of the mechanisms in so far as biochemical investigation has indicated. An instance of striking synergism is also reported between ozone and hydrogen peroxide.

At least four significant contributions to our understanding of the acute short-term interactions of smog components have been made.

(1) A theory of physicochemical interaction, based on experimental work on the biological effect of mixtures of aerosols with gases and vapours, which provides a basis for predicting future abnormal response of synergism and antagonism among certain chemically or catalytically active smog components has been developed.

(2) Many oxidant smog combinations have been shown to possess the capacity to confer protection on the host against acute effects from further exposure and also to provide a cross-protection against chemically dissimilar oxidant smog components.

(3) The findings of marked similarity to radioprotective substances in the type of sulphur compounds that provide protection to animals against the acute effects of typical smog oxidants focuses attention on the radiomimetic properties of certain oxidants and brings into closer relationship the biologic effects of radiation and certain oxidant air pollutants.

(4) Oxidant smog mixtures derived from petroleum combustion appear to contain some components that are

mutually antagonistic physiologically against the short-term effects of their inhalation.

**454. Die Westdeutschen Mass nahmen Zur Reinhaltung Der Luft: Die "Kommission Reinhaltung Der Luft," Ihr Arbeitsprogramm Und Ihre Bisherige Tatigkeit.** Schwarz, K. (In German), (Int. J. Air Poll. **2,** 346-356, June 1960). The paper reviews the efforts made in Western Germany to reduce air pollution and describes the work done by the "Commission for Clean Air" and its achievements to date.

On the initiative of the "Interparliamentary Working Party," the Commission for Clean Air was formed in 1957. On it are represented the main producers of air pollution and also those who suffer from it, as well as scientists and technologists. The Commission elaborates technical "Regulations" in which measures for reducing pollution are given and maximum permissible concentrations are defined.

A general covering act ensures that these regulations have the force of law.

This has the advantage that the regulations can, from time to time, be altered so as to represent continuously the latest stage of knowledge in science and technology without having to involve, every time, the machinery of passing a new law.

As far as possible, the permitted concentrations of materials which are harmful or constitute a nuisance (emission) are based on their effects elsewhere and are hence based on permissible concentrations in the neighbourhood of the source. The actual concentrations of pollution in the air is called the immission.

The Commission has worked in the following four fields:

(1) Study of methods of measurement for the different components of emission or immission: Regulations defining uniform and sufficiently reliable methods of measurement.

(2) Study of the effects of the different materials emitted on organisms and building materials: Regulations covering maximum permitted concentrations in air (Mik values—maximum immission Konzentration).

(3) Study of the dispersal of gases and dust in the atmosphere, in particular the relationship between emission and concentration in the neighbourhood (immission): Regulations for calculating dispersion of pollutants.

(4) Study of possibilities for reducing emission of noxious or nuisance materials: Regulations covering emission concentrations with reference to the results obtained under (2) and (3) above.

In many detailed parts of this wide field of work there does not exist sufficient information in Germany or abroad to justify laying down regulations which have the force of law. Therefore a *programme of research* was set up, and is continually kept under review, in order to fill the gaps of knowledge in the four sections described above.

The paper describes in which fields work is going on and gives the first results obtained.

As a result of all these efforts, a number of regulations have been published which describe methods of reducing emission and state maximum allowable concentrations of emission for some of the most important sources of pollution, i.e. steam boilers, ore sinter plants, cement factories and others. Further regulations are nearly finished. These cover emission from industrial and domestic heating installations and permissible concentrations of noxious gases in air (sulphur dioxide, hydrogen sulphide and nitrous oxides). The first regulations for methods of measurement and interim regulations for calculating dispersion are also nearing completion.

The corresponding covering general Act has, in the meantime, been passed by the Federal Government so that the way for enforcing the regulations is now clear.

**455. Re-entrainment of Settled Dusts, The.** Bagnold, R. A. (Inter. J. Air Poll. **2,** 357-363, June 1960). The re-entrainment of settled dust deposits depends on a number of variable factors concerning both the internal structure of the wind and the composition and structure of the deposit. Owing to lack of understanding of the nature and magnitude of cohesive forces between fine particles quantitative knowledge is confined largely to the entrainment of particles bigger than 80$\mu$ by steady parallel fluid flow.

Under steady conditions the determining property of the wind is the drag it exerts on the boundary surface of the deposit. This drag can be inferred from measurements of the velocity gradient. The threshold wind gradient at which the deposit surface is disturbed decreases with particle size to a minimum of about 100$\mu$. Its increase as the size is further reduced is due in the first instance to the effects of air viscosity. But cohesive effects soon become dominant, and seem capable of

increasing the resistance to disturbance indefinitely. Deposits of fine powders can however be readily dispersed by the ballistic impacts of dust particles larger than 100; and locally by previous mechanical disturbances which have caused sharp edges of the deposit to protrude into the wind stream.

**456. Effects of Vertical Temperature Difference on Soiling Index.** Markee, Jr., E. H. (Proc. A.P.C.A. 53rd Annual Meeting, May 1960). Statistical analyses of the relationships between urban vertical temperature difference measurements obtained from a TV tower and soiling index measurements from the same urban complex were made. The results of these analyses are discussed in terms of averaging time and diurnal variation.

**457. Sampling Stations and Time Requirements for Urban Air Pollution Surveys.** Keagy, D. M. et al. (Proc. A.P.C.A. 53rd Annual Meeting, May 1960). Information resulting from the operation of 123 air sampling stations for certain air pollutants at Nashville, Tenn., permits the authors to draw conclusions regarding the optimum geographic spacing, sampling frequency, and sample duration required to characterize air pollution patterns in a community. This intensive air sampling was done for 12 consecutive months as part of the Nashville Community Air Pollution Study conducted by the Public Health Service during 1958-59. Samples of particulate matter and sulphur dioxide were collected continuously in a network of sampling sites and for various durations. These were analyzed in terms of diurnal, daily, monthly, and seasonal variations as well as variations between small geographical areas of the community.

**458. Achieving Greater Sensitivity in Source Sampling by the S-N Modification to the High Volume Air Sampler.** Sterling, M. and Nimlin, S. (Proc. A.P.C.A. 53rd Annual Meeting, May 1960). The high volume air sampler is a useful tool for determining the extent of particulate emissions from suspected emission sources. Due to constant variations in wind directions during the sampling period, the actual extent of pollution from a suspected source will tend to be minimized. In an effort to obviate this deficiency, a special switching mechanism attached to a wind indicator and recording device makes it possible to operate the high volume sampler only during periods when the wind is coming from a restricted sector with relation to the suspected emission point. If another high volume air sampler is operated during the period the source sampler is off, the background loading can be sampled simultaneously and significant differences of loading can be determined in a relatively short time. Information is provided on the results obtained from recent field studies and details of equipment modification.

**459. Mortality Studies and Air Pollution Indexes.** Schiffman, R. (Proc. A.P.C.A. 53rd Annual Meeting, May 1960). At the present time there are no completely adequate data for categorizing levels of air pollution throughout the U.S. Accordingly, a large number of indexes have been prepared by the Air Pollution Medical Programme for use as indirect measures to study the possible relationship between these imputed measures of air pollution and mortality. The construction of these indexes has been based on potential sources of air pollution such as measures of home heating, specific and non-specific industry, service station sales, etc. This paper is concerned with relating a sub-group of these indexes with selected cancer and heart mortality causes. Some positive relations have been shown to exist indicating the need for further research.

**460. A Recommended Method for Soiling Index Surveys by Automatic Filter Paper Sampler.** Schumann, C. E. and Gruber, C. W. (Proc. A.P.C.A. 53rd Annual Meeting, May 1960). This paper is based upon the investigative work in the preparation of the recommended method for soiling index surveys presented to the A.P.C.A. Committee on Air Measurements. The AISI sampler is selected as the instrument for which the method is written. Included is a general discussion on the planning and maintenance of sampling stations along with a calibration and spot evaluation procedure. Two procedures are given. The first is based upon both transmitted and reflected light for spot density determinations; an alternate procedure is also included for evaluations by either transmitted or reflected light. Some of the significant variables inherent in optical density measurements of fibrous filter papers are also given.

**461. Air Pollution Potential Advisory Service for Industrial Zoning Cases.** Breivogel, M. et al. (Proc. A.P.C.A. 53rd Annual Meeting, May 1960). Many local

planning agencies, sitting as quasi-judicial hearing bodies on zoning matters, have indicated the need for air pollution potential implications as a decision-making factor in the granting or denying of industrial zoning cases. The public hearing before the planning commission affords the opportunity to balance the opposing viewpoints in the establishments, expansion or continuance of industrial uses or zones. The benefits from the air pollution potential advisory service are three fold: (1) the planning officials consider the air pollution potential in the justification for granting or denying the industrial or zoning case, (2) the control officials receive an early warning of future industries and may attach specialized control regulations, and (3) the industrialist is alerted of control equipment requirement prior to construction-time avoiding costly alterations of plans and buildings. A formalized referral system for industrial zoning cases has been established between the planning agencies and the L.A.A.P.C.D. The discussion presents the descriptive and evaluative aspects of the referral system for industrial zoning cases submitted by the L.A. County Regional Planning Commission. Satisfactory built-in controls were attached as conditions for cases involving specific industrial uses. Air pollution potential from industrial zones, where a mixture of zero to high air pollution potential uses were permitted, could not be adequately forecast. Additional research is needed to estimate quantitative air pollution potentials from area sources.

**462. Experiences in Industrial Performance Standards for Zoning.** McCrone, W. C. and Salzenstein, M. A. (Proc. A.P.C.A. 53rd Annual Meeting, May 1960). The authors relate their experiences in drafting industrial performance standards, particularly those dealing with air pollution, in various municipalities. The basis and justification of the units and numbers chosen are given, and how administration and enforcement problems are handled. The objections raised by certain industries to the performance standards are cited along with the authors' replies.

**463. Meeting the Deterrents to Effective Zoning Control of Area Source Air.** Pomeroy, H. R. (Proc. A.P.C.A. 53rd Annual Meeting, May 1960). It is obvious that zoning as a measure of alleviating air pollution must be applied on a metropolitan basis, necessitating some degree of overall direction. Except in the face of disaster, it is not likely that such direction will be readily accepted by the local governmental units in a metropolitan area, frequently numbering into the hundreds. In the absence of effective metropolitan-wide direction, reliance will have to be placed on voluntary association, plus working participation in the undertaking. Counties should be used as agencies of co-ordination in process. In approaching the problem of formulating a metropolitan framework for zoning related to air pollution, account should be taken of disparities between municipal costs and revenues in relation to various land uses; relief may have to be sought in the field of governmental finance in order to avoid the danger of warping sound zoning patterns in attempts to balance the municipal cost-income ledger. In any metropolitan area there will be individual municipalities that will be unable to establish and maintain technical services needed in the application and administration of zoning regulations related to air pollution, including industrial zoning performance standards. Some means should be provided for making competent technical assistance available to such municipalities. The effectiveness of control measures should be subject to continuing check. Continuing research is needed for the improvement of methods of regulation.

**464. Development of Motor Vehicle Exhaust Emission Standards in California.** Maga, J. A. and Hass, G. C. (Proc. A.P.C.A. 53rd Annual Meeting, May 1960). The 1959 State Legislature enacted bills requiring the California State Department of Public Health to adopt air quality and motor vehicle exhaust standards by February 1st, 1960. This paper describes the motor vehicle exhaust standards that were adopted and the methods used to develop the standards. The motor vehicle exhaust standards are based on the air quality standards and take into consideration existing air pollution levels and the contribution of the motor vehicle exhaust to the air pollution problem of California metropolitan regions. The paper presents data and assumptions used to arrive at the standards.

**465. An Interim Report on Full-Scale Study of Dispersion of Stack Gases.** Gartrell, F. E. et al. (Proc. A.P.C.A. 53rd Annual Meeting, May 1960). In the period 1953-56 the titrilog was adapted for operation in a helicopter to supplement

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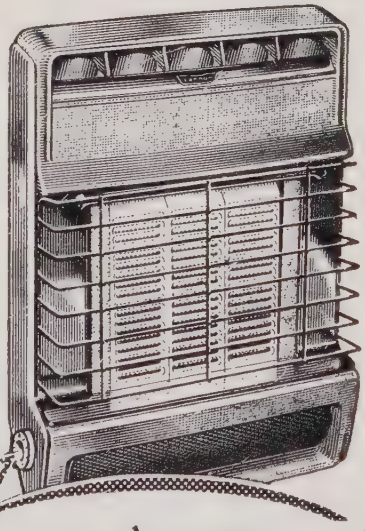
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ground based monitoring instruments, Thomas autometers. Techniques were developed for defining the $SO_2$ concentration and the geometry of plumes from large coal-burning steam plants. In 1957 a three year full-scale study of dispersion of stack gases was undertaken under a research contract with the U.S. Public Health Service. This report summarizes findings to date.

**466 Research on Control of Emissions from Bessemer Converters.** Orban, A. R. et al. (Proc. A.P.C.A. 53rd Annual Meeting, May 1960). In work sponsored by the American Iron and Steel Institute a 300 lb. experimental Bessemer converter was assembled at Battelle which closely simulated blowing conditions of a commercial vessel. It was built to explore, under controlled conditions, a means to prevent the formation of smoke during turnup, blowing, and turndown. The inside diameter of the vessel is $12\frac{1}{2}$ in. and the inside height is 54 in. Air and other gases are admitted through a removable bottom containing 20 $\frac{1}{8}$ in. diameter tuyeres. To compensate for excessive heat losses from the vessel because of its large surface-to-volume ratio, auxiliary heat is supplied by means of an induction coil surrounding the vessel. Dust loading in the effluent gas when blowing with air averaged 0.51 lb. per/1,000 lbs. of exhaust gas. This was closely similar to the exhaust-gas loading of a commercial vessel. When blowing the laboratory vessel with air enriched to 22 to 24 per cent. oxygen, the average dust loading was 1.04 lbs. per/1,000 lbs. of exhaust gas. Samples of smoke particles were collected from inside the converter nose through a water-cooled probe and maintained in an inert atmosphere. By chemical analysis, approximately 25 per cent. of the total sample contained iron. Of this amount, approximately 19 per cent. was metallic iron, 75 per cent. was iron as FeO, and 6 per cent. was iron as $Fe_2O_3$. The addition of hydrogen to the blast gas of the laboratory converter usually caused a decrease in smoke density. This effect was not as clearly pronounced when hydrogen was added throughout the carbon blow as when it was added for short periods near the end of the blow. The addition of hydrogen was accompanied by a decrease in flame intensity. Although the results are not conclusive, there was an indication that the weight of smoke per pound of exhaust gas decreased slightly when hydrogen was added to the blast gas. A material balance from the exhaust gas analyses indicated that the amount of hydrogen in the exhaust gas was the same as that added to the blast. Whether hydrogen entered into reactions in the tuyeres or in the bath is not known. The addition of steam to the blast gas also showed a decrease in the intensity of smoke discharged from the small converter which duplicates the effect of steam usually noted on full-scale converters. Work is continuing with increased emphasis on bench-scale investigation of the mechanism of smoke formation in the converter process.

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# WARWICKSHIRE CLEAN AIR COUNCIL

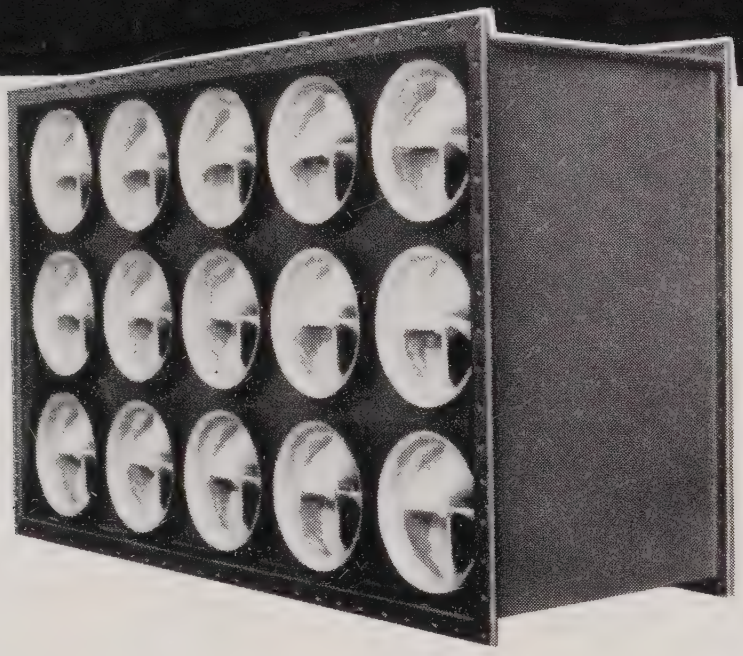
The 3rd Annual Report of this Council, for 1959-60, is a most interesting document, clearly showing the valuable co-operative work being done by the Council and its constituent local authorities. As far as we know, no other similar body is carrying out a programme of such a useful nature.

The measurement of pollution in the county is co-ordinated, and there is a full report by the Analyst, Mr. W. M. Lewis, of the City Laboratories Service, Coventry. Detailed tables of the measurements made are given.

There is also a report of the Council's Technical Advisory Committee. This body, in addition to work on the measurement of pollution, advises the constituent authorities on prior approval applications, and during the year dealt with ten such applications. It has also given guidance on fifteen applications concerning chimney heights.

As appendices to the report, for the assistance of others, are given the code of requirements for prior approval used by Coventry Corporation, and a questionnaire to secure the required information for both prior approval and chimney heights.

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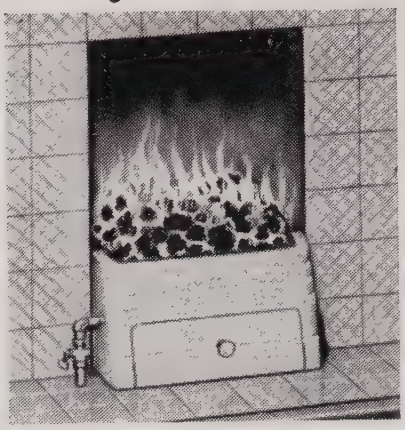
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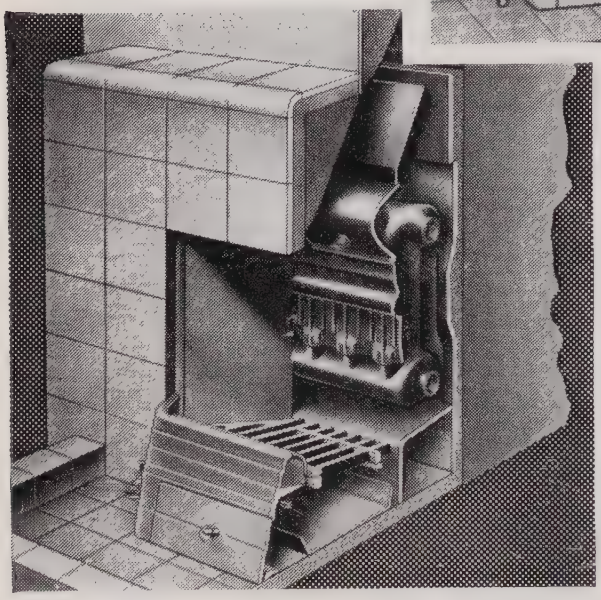
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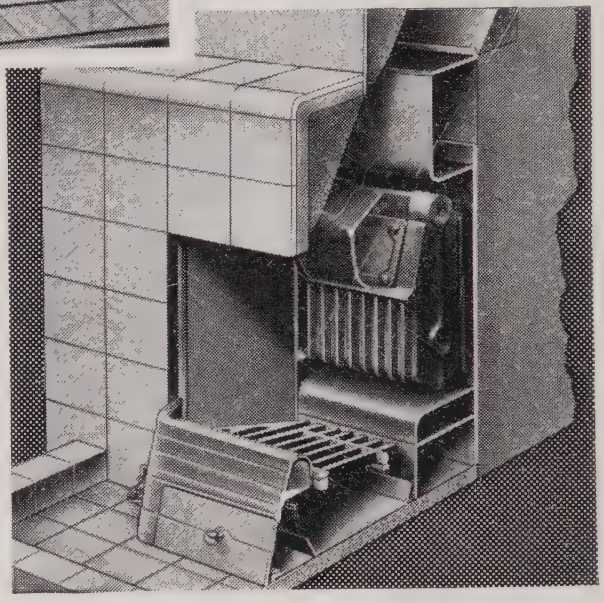
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## IDEAL NEOFIRE No. 10

*British Patent No. 753719*



The Ideal No. 10 Neofire is primarily designed for Direct Hot Water Supply, with a cylinder of not less than 30 gallons. The boiler can be Bower-barffed (rust resistant treatment) for use in soft water districts.
In hard water areas the No. 10 Neofire can be installed to provide both Domestic Hot Water *and* Background Heating.

Each Neofire has a boiler of sufficient power to take care of approximately 40 square feet of radiation, plus an average amount of piping, and to provide hot water for all domestic purposes with a cylinder of 20 gallon nominal capacity. Designed to burn smokeless fuel, Ideal Neofires consume approximately 2 lb. per hour, utilising up to 60 per cent of the heat contained in the fuel, compared with 15-20 per cent by the ordinary open fire.

*Standard colours are Cream Mottle, Black, Copper Lustre.*

# IDEAL NEOFIRE

*Over 200,000 NOW INSTALLED in post-war homes!*

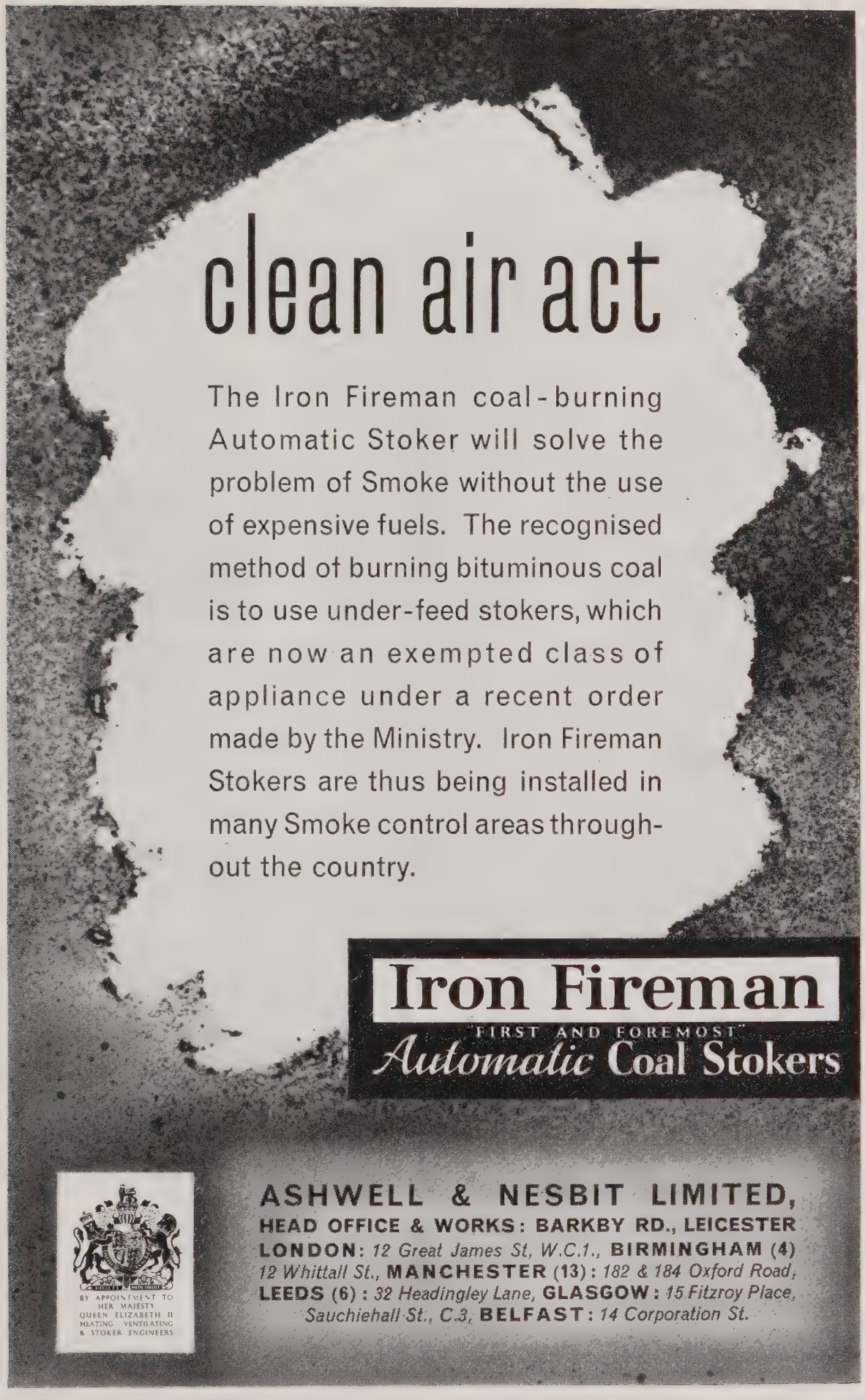
*A working demonstration model of the Ideal Neofire may be seen at Ideal House, Great Marlborough Street, London, W.1*

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IDEAL-Standard

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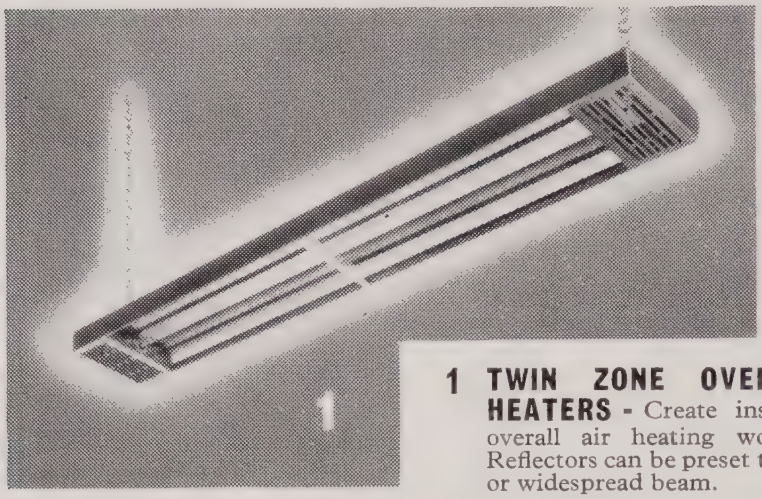
321A


clean air act
The Iron Fireman coal-burning Automatic Stoker will solve the problem of Smoke without the use of expensive fuels. The recognised method of burning bituminous coal is to use under-feed stokers, which are now an exempted class of appliance under a recent order made by the Ministry. Iron Fireman Stokers are thus being installed in many Smoke control areas throughout the country.
Iron Fireman
FIRST AND FOREMOST
Automatic Coal Stokers
BY APPOINTMENT TO HER MAJESTY QUEEN ELIZABETH II HEATING VENTILATING & STOKER ENGINEERS
ASHWELL & NESBIT LIMITED,
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## *Every Heating Installation has its own problem*

# Which G.E.C. system is best for you?

The G.E.C. manufactures a full range of industrial electric space heating equipment, providing complete installation schemes to meet any type of individual requirement. A G.E.C. planned scheme means all-round economies — in layout, erection time and fuel consumption.





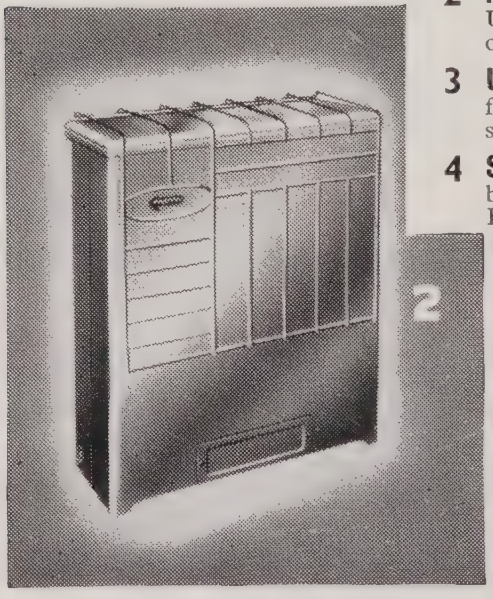


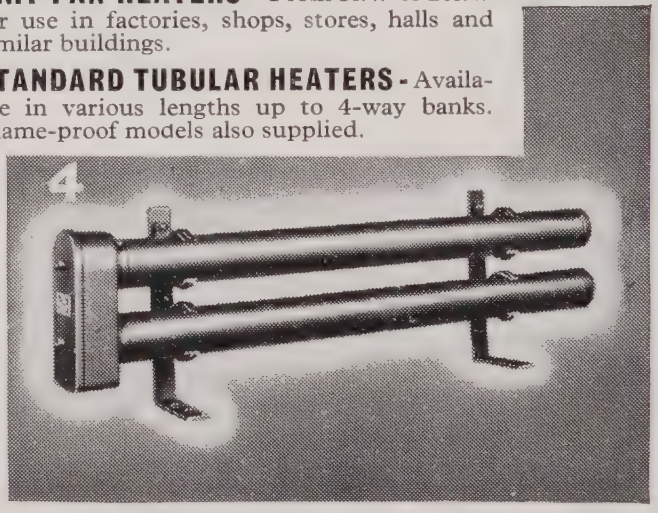
1 **TWIN ZONE OVERHEAD RADIANT HEATERS** - Create instant warmth where overall air heating would be too costly. Reflectors can be preset to give a concentrated or widespread beam.

2 **NEW DESIGN NIGHTSTOR HEATERS** - Use electricity at night when special low cost off-peak tariffs are available.

3 **UNIT FAN HEATERS** - From 3kW to 20kW for use in factories, shops, stores, halls and similar buildings.

4 **STANDARD TUBULAR HEATERS** - Available in various lengths up to 4-way banks. Flame-proof models also supplied.




*Write for publication H5 for further details*

G.E.C. ***Industrial Electric Space Heating***

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

# ...but there is fire without smoke

WITH A **BAXI** PATENT **FIRE**

The Baxi Patent Fire, the original under-floor draught fire, is officially approved for Smokeless Areas by the Ministry of Power, the Coal Utilisation Council and the Solid Smokeless Fuels Federation

**OVER QUARTER OF A MILLION BAXI FIRES HAVE BEEN SOLD!**

There are Baxi fires for continuous burning, central heating, convector heating and abundant domestic hot water.
There are also Baxi fires suitable for both solid floors and upstairs rooms.



The under-floor draught of the Baxi Patent Fire enables you to make a bright and cheerful fire with coke. The fire will also, of course, burn any other type of smokeless fuel.

*For free descriptive leaflets write to:*
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Telephone : Chorley 2808 (3 lines)

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**ordered in the twelve months commencing 1st November 1959.**

**Hire purchase terms are available from that date.**

This offer is made in recognition of the national importance of maintaining a healthy coal industry and in support of the National Coal Board Campaign.

Proved by 17 years' successful operation, the Oldbury Stoker endorses the claim of the National Coal Board that coal, the home produced fuel, is competitive in price and performance with other fuels.

The Oldbury Stoker, the first successful chain grate stoker for shell boilers, was developed by Edwin Danks of Oldbury in 1942 with the prime object of burning efficiently low grade slacks, owing to the shortage of graded fuels. To-day, more than 6,000 Oldbury Stokers are in the service of industry, burning all sorts of solid fuel.

**ECONOMICALLY**
by reducing fuel and labour costs.

**SMOKELESSLY**
in compliance with the Clean Air Act.

Manufacturers who appreciate the manifold advantages of burning Britain's native coal are invited to send for details of our Special Offer and Publication 1618 THE OLDBURY STOKER.

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# For Brighter, Warmer Homes in Smokeless Zones



## QUEEN-HEATER

**Design of the Year Award Winner 1959**

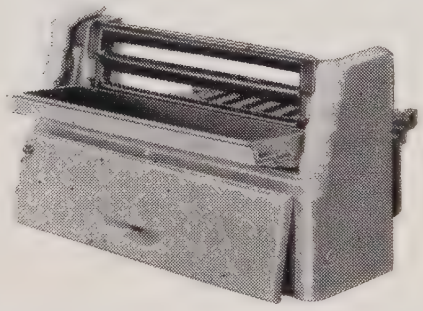
Winner of a Design Centre Award as one of the 16 products of outstanding design chosen from 3,000 articles displayed at the Design Centre during 1958. In a range of four colours. Boiler model available. Tested and approved by Ministry of Power and Good Housekeeping Institute. Will burn all solid fuels.

Price from £22

## QUEEN No. 51C (D.F.) Drop-Front FIRE

This inexpensive all-night burning fire cuts fuel bills and saves the trouble of kindling each morning. In sizes to fit and colours to match your present fireplace.

Price from £4 17s.





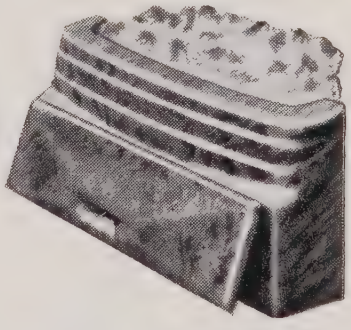
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Prices from as little as £4 6s.

## QUEENETTE Low Front FIRE

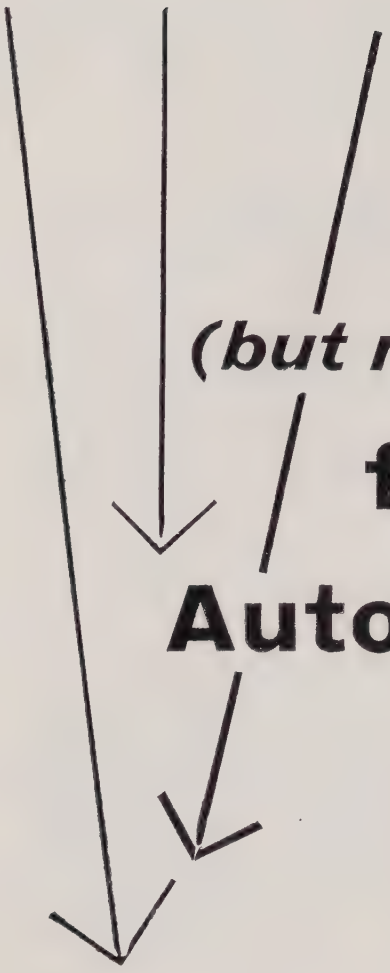
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**All these Appliances meet the requirements of the "Clean Air" Act and are most suitable for installation in Smokeless Zones. These types can burn Smokeless Fuels.**

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**Grahamston Iron Co. Ltd. · P.O. Box No. 5 · Falkirk · Stirlingshire**



# A puff here

## *(but no sign of smoke)*

# for 'Potterton' Automatic Boilers

No smoke without fire? Perhaps. But plenty of heat without smoke when your central heating has a 'Potterton' Boiler under its command, doing all that's asked of it *automatically*.

Whether your choice is gas-firing or oil-firing there's a 'Potterton' Boiler small enough to warm a bungalow or large enough for industrial use, and each is unsurpassed for efficiency and economy.

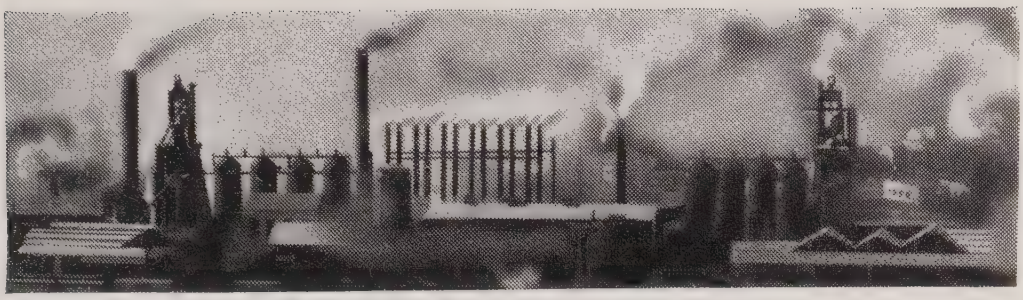
Write to Miss Meredith at the address below for full information and running costs.

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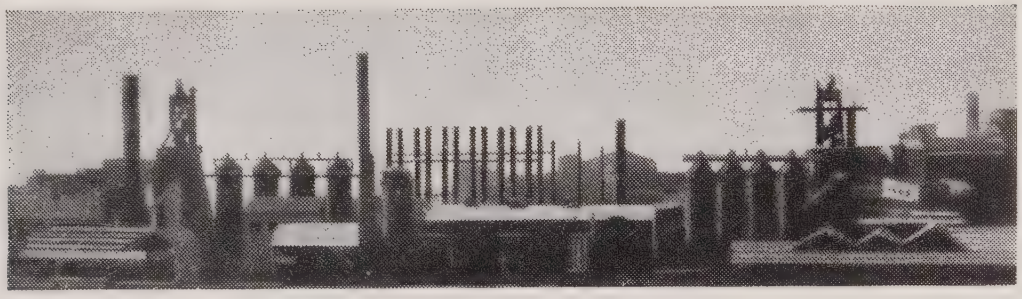
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# Question

which type of
dust collection and
control plant?



# Answer

consult
Holmes

We have specialised in the design, manufacture and installation of dust collection and control plant for a good many years and today our range is second to none. Plant manufactured by our Gas Cleaning Division includes: Holmes-Elex Electrical Precipitators: Holmes Retroflux and Standard Bag Filters: the Holmes Schneible Multi-Wash System: Holmes-Rothemuhle Multi-Cell Cyclone Dust Collectors and Trion Electronic Air Filters. Enquiries normally entail visits to site by an engineer from our Test and Process Development Section to assess the particular problems involved and their solution in terms of the comprehensive range of plant which is available. Extensive laboratory facilities exist for the examination of dust and fumes, and, where necessary, arrangements can be made for pilot plants to be installed for trial purposes. Detailed technical brochures on all types of plant are available and can be had on request.

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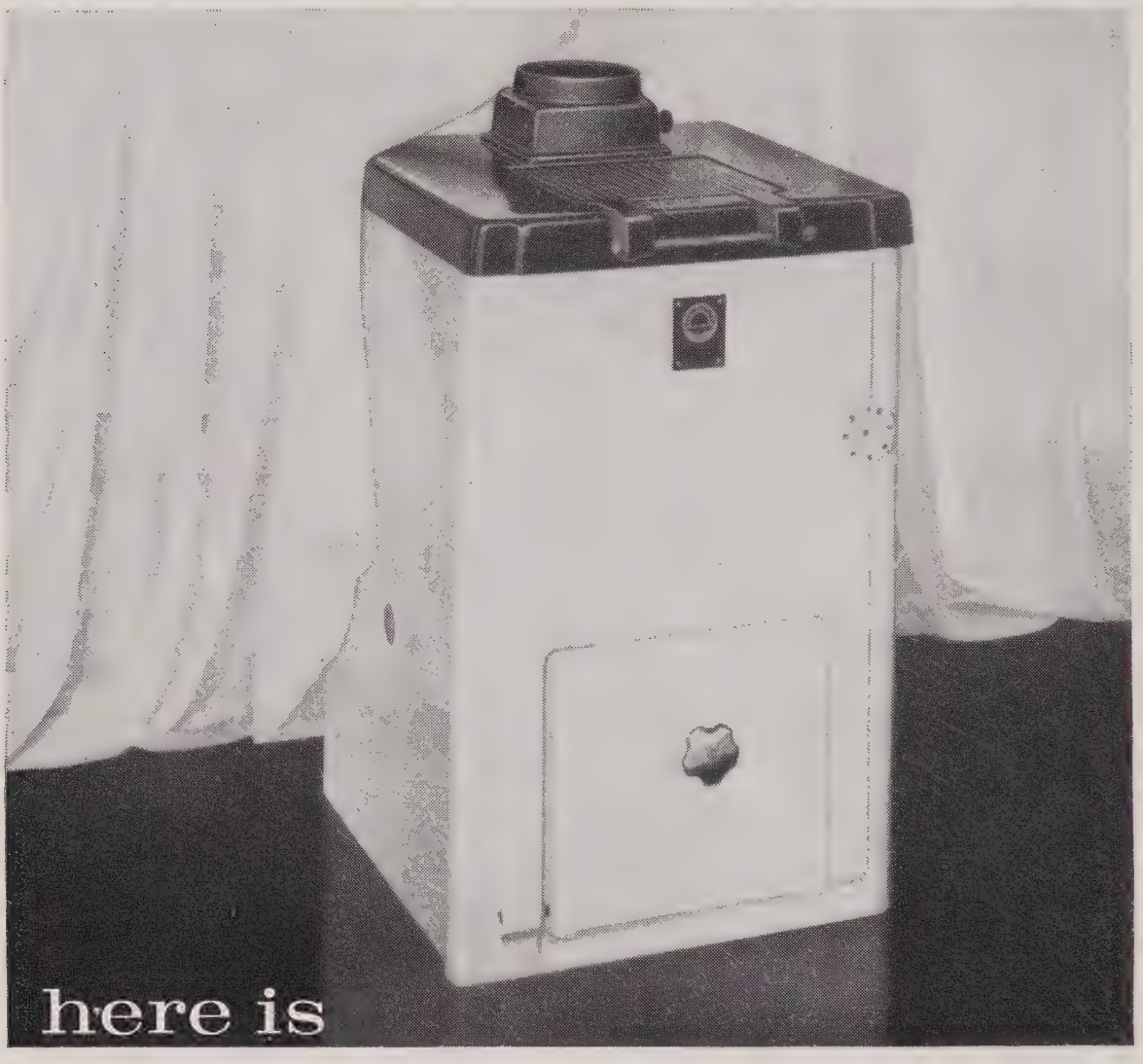



No. 116 ★ WINTER 1960 ★ 2/-

*In this Issue*

Harrogate Conference: Addresses by Sir Keith Joseph, M.P. and Sir Hugh Beaver ★ National Survey of Air Pollution ★ Air Pollution and its Effects on Man by P. J. Lawther ★ Aerosol Pollutants by R. Lessing ★ Sir Ernest Smith ★ New Electric Firelighter

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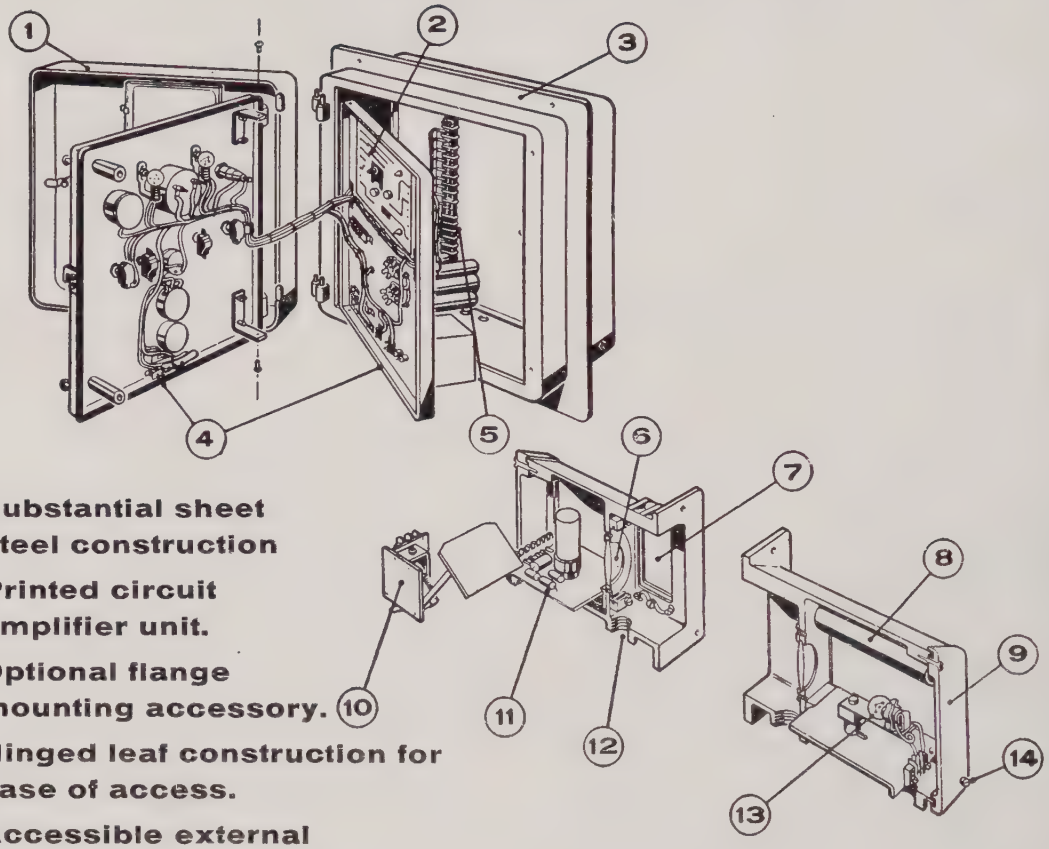
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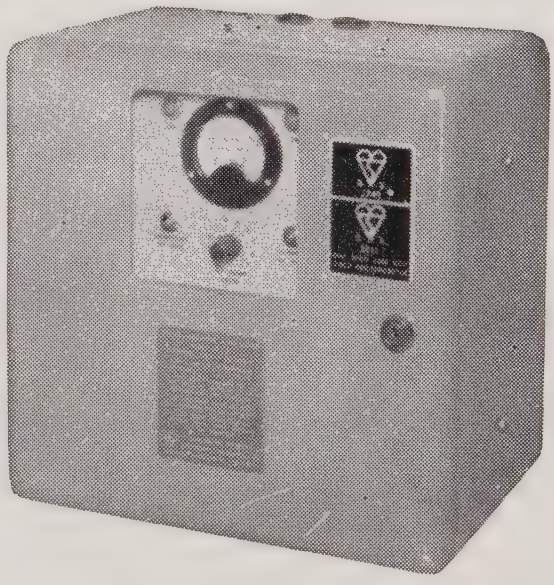
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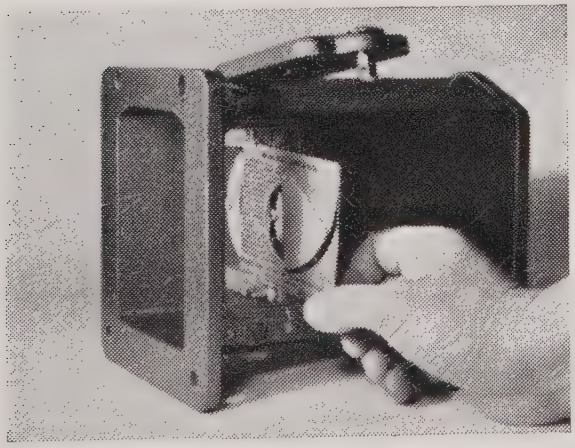
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* This equipment is the first of its kind to carry the British Standards Institution's "Kite Mark", which indicates independent certification of compliance with BS.2740/56 or, plus the appropriate indicating instrument, with BS.2811/57.



*Main unit showing locked away controls and calibration meter.*



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## Electric floor warming is the cheapest and easiest heating system to install



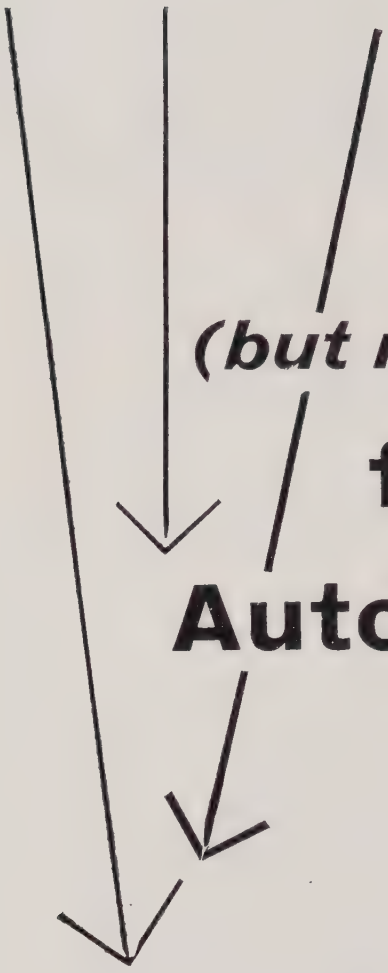
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## *(but no sign of smoke)*

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Whether your choice is gas-firing or oil-firing there's a 'Potterton' Boiler small enough to warm a bungalow or large enough for industrial use, and each is unsurpassed for efficiency and economy.

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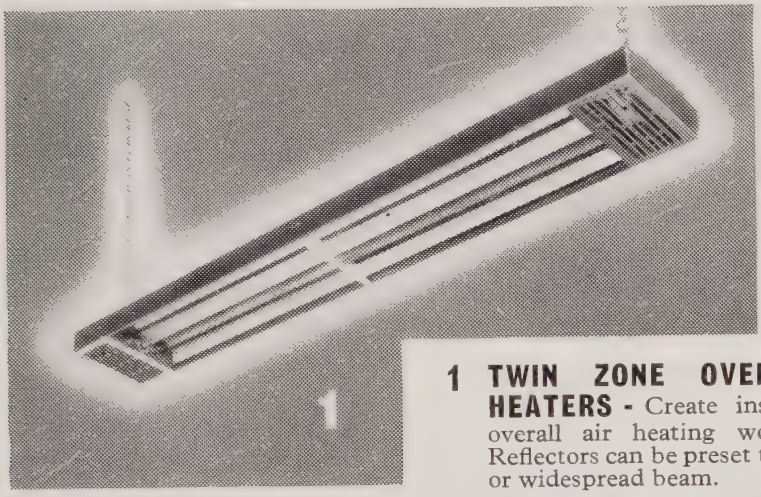
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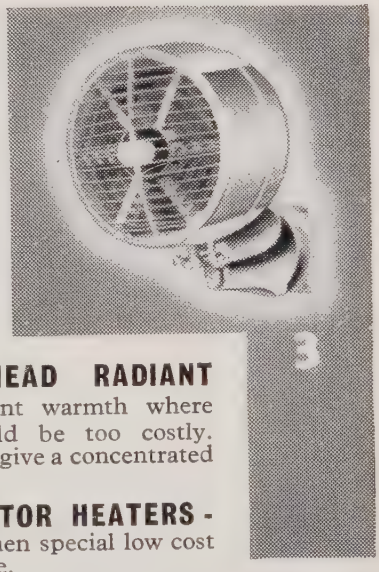
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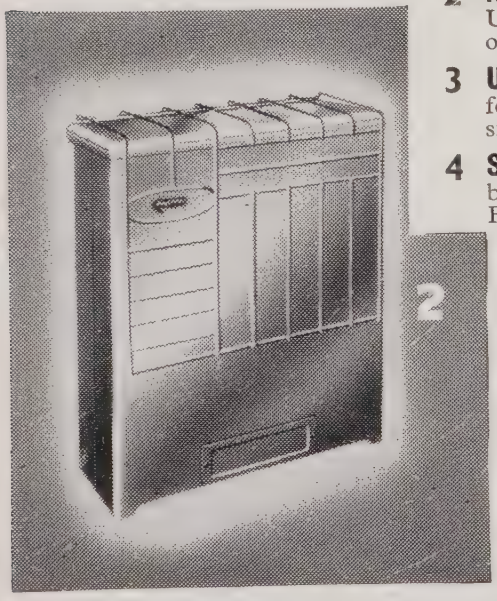



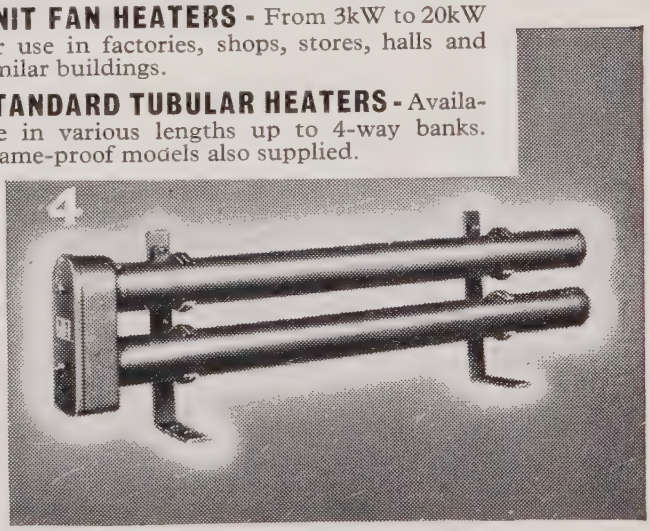

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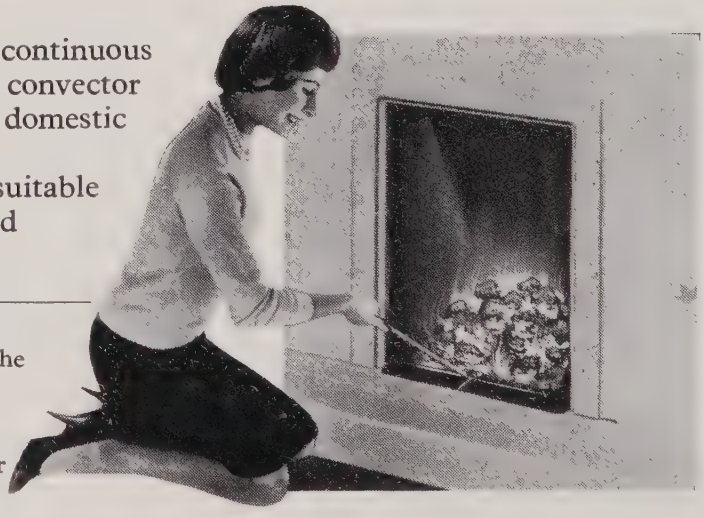
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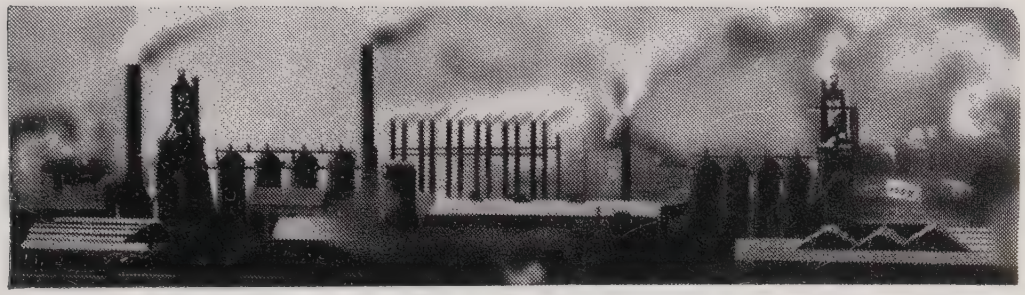
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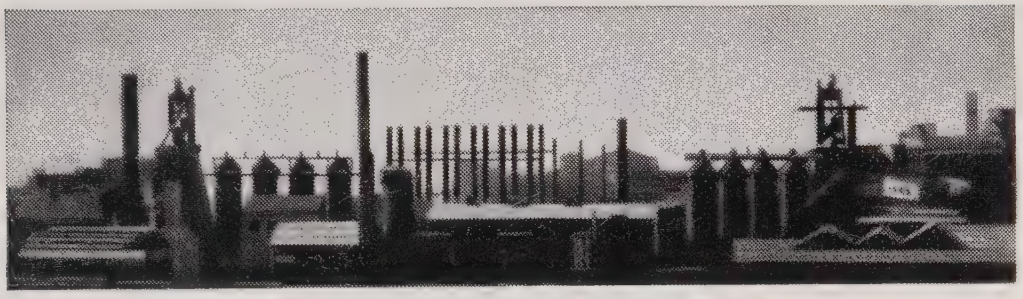
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# Question

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dust collection and
control plant?



# Answer

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Holmes

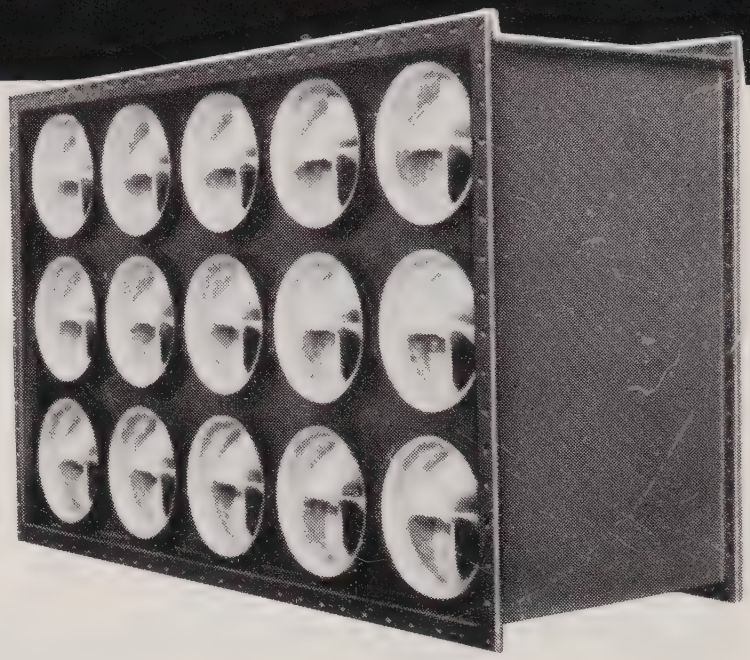
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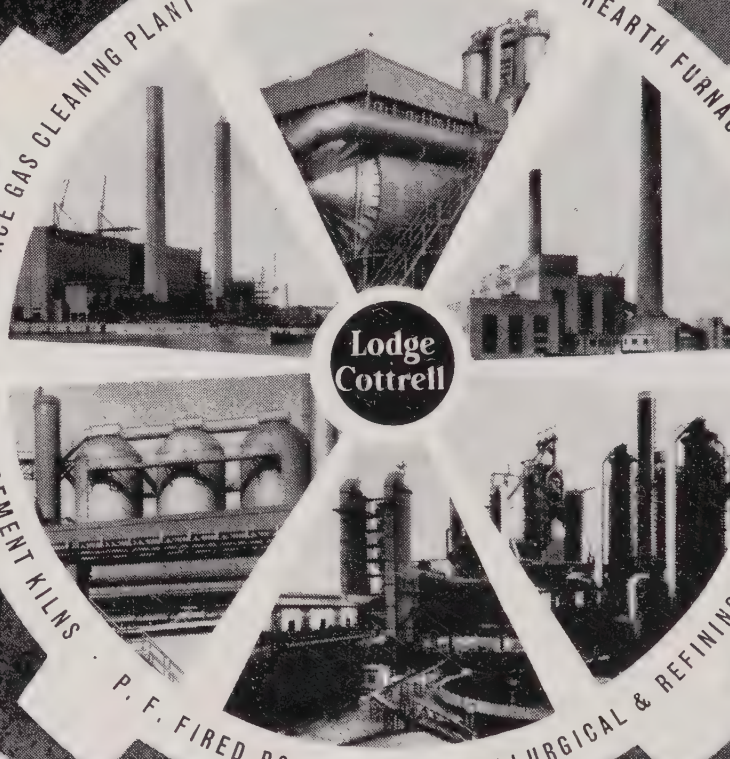
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# SMOKELESS AIR

Vol. XXXI No. 116 Winter 1960

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*Ships, towers, domes, theatres and temples lie*
*Open unto the fields, and to the sky;*
*All bright and glittering in the smokeless air.*

# SMOKELESS AIR

## Harrogate

THE concensus of opinion, and not merely our own view, is that the Society's conference at Harrogate in October was the most successful ever held. It is impossible to compare it with the International Conference in 1959, but some, of more insular mind maybe, have ranked it even above that for value.

Two things stand out—the quality of the conference programme and the quality of the exhibition. The programme may have been a little full as far as time for presentation and discussion at the conference itself was concerned, but the more lasting value of the printed papers, which will be read and studied by many more than those attending the conference, is of equal importance. From the statesmanlike addresses by the President and the Parliamentary Secretary, the sparkling Des Voeux Memorial Lecture, to the technical reports, the road vehicle contributions, and the reports on the Society's questionnaire to local authorities, the papers were all positive and constructive, and without exception they have materially helped forward the clean air movement.

The same must be said of the Exhibition. Not only was it the biggest clean air exhibition we (or anyone else) have so far organized, but it was also the best for quality and for appearance. For all this the exhibitors must be accorded a bouquet—not only were the exhibits eminently practical and of real interest, and not only did they, together, cover the ground most comprehensively, but the way in which they were displayed was gratifyingly attractive. The Exhibition had, in fact, an air of simple elegance that impressed everyone. It was well attended, not only by the thousand delegates to the conference, but by many business men, technologists and other " top people " from Yorkshire. The success of the Exhibition can perhaps be gauged by the interest of the exhibitors, already very evident, in next year's events at Brighton.

One of the great assets of the Conference (and indeed of the Society itself) is that it represents all clean air interests. These make up a remarkably wide spectrum, from the highly technical and medical to the layman attending his first conference and just beginning to discover the many aspects of the problem. It is invaluable that they should meet, talk, listen and understand each other; but it is inevitable that some things are too technical for one minority and are not discussed on an adequately learned level for another minority. We think that the great majority can adjust themselves quite happily. This slight dichotomy is the cause of the only criticisms of the conference that we have heard, and the Conference Committee is already considering whether it may be possible to arrange an extra, specifically technical, session. It is interesting to note that the proportion of technical, industrial and other delegates is steadily growing—a sign of the wider and more co-operative interest in clean air now being taken in industry.

A further feature of the conference was the number of oversea delegates attending, many of them friends who had been with us at Seymour Hall last year. We were very glad indeed to see them again.

## Lord Simon

It was a sad coincidence that the Harrogate Conference should have opened with the news of the death of Lord Simon of Wythenshawe, for it was at the conference in 1948, in the same hall, that he had delivered his one Presidential Address to the Society. Lord Simon has an honoured place in the annals of the movement for clean air. As E. D. Simon he was in 1909 one of the founders, and the first honorary secretary, of the Smoke Abatement League of Great Britain, and he took a leading part in the development of smoke abatement activity in Manchester—the city for which he later became Lord Mayor. His title reflected his close association with the imaginative development of Wythenshawe, and his generous gift to the city of Wythenshawe Park.

Born in 1879, Lord Simon had a distinguished career: he was President of Simon Carves Ltd., had been a Member of Parliament and Parliamentary Secretary to the Minister of Health; he was a member of the 1920 Newton Committee on smoke abatement, and in more recent years was Chairman of the Domestic Fuel Policy Committee, the report of which was more strongly in favour of more vigorous clean air measures than any other previous Government Committee. He was co-author, with Marion Fitzgerald of a valuable little text book that deserves not to be forgotten—*The Smokeless City*. Between the wars his social reform activities were largely devoted to the housing problem, to the study of which he made, as in all his work a notable contribution.

## Diesels

One of the most important of the conference sessions was that devoted to the prevention of diesel vehicle smoke and fumes. The four papers presented make up, in our view, the most useful document on the problem yet published. It was very encouraging, too, to have present as delegates representatives of the various road transport organizations, and to have their views in the discussion; and also to have with us representatives of the police authorities. It is also encouraging to note the approving reports and comment on the papers in the motor transport press. We feel that the time has now arrived for pressing for a sweeping revision of the present ineffective legislation, and for proposing control on the lines indicated by Mr. Lister in his paper—that is, something similar to the Durban method as first described by K. R. Johnson in his paper to the International Conference. The police (or other authority) would have power to require any vehicle emitting excessive smoke to proceed at once to a testing station for an engine examination (which can be done expeditiously with the excellent equipment now available); and to require any necessary work to be done, possibly before the vehicle is allowed back on the road. This procedure would almost certainly be most effective, and seems to be very much better than waiting for devices for burning smoke which need not have been formed.

## Rail Slowdown

Turning from road to railways, the Society naturally welcomed the B.T.C. modernization plan because it embodied, through electrification and dieselization, the best and indeed the only policy for abolishing the inevitable nuisance of smoke and grit from the steam locomotives that are still with us in large numbers. The railways in Britain have done a great deal to reduce the smoke from steam locomotives, but technically it is almost impossible to abolish it completely, and it is still a considerable problem in many localities, especially around locomotive sheds and marshalling yards. The speedy completion of the modernization plans has been an earnest wish of the clean air movement, and from this point of view, apart from all the other considerations, it is regrettable that the Government should be slowing down the rate

of progress, and that parts of the plan may be jettisoned or delayed. We know that clean air can be regarded only as a special aspect of a much bigger question that it is outside our terms of reference to criticize—but all the same, it is a pity.

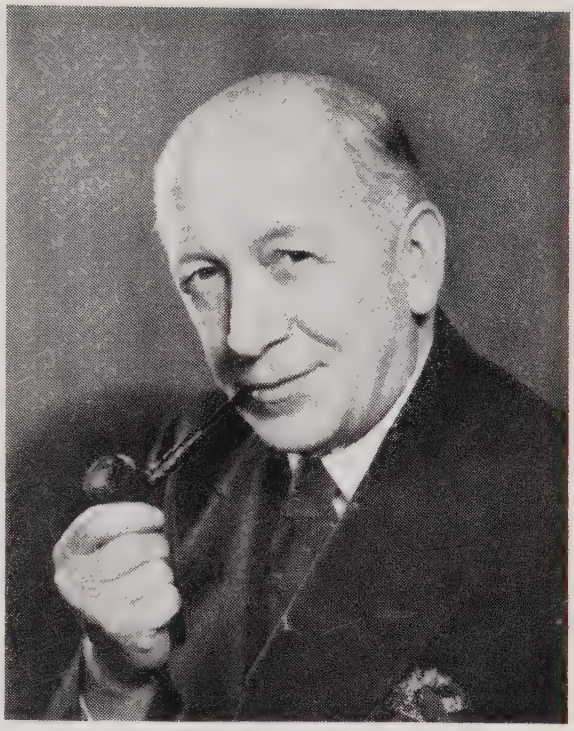
## The Society's Home

Elsewhere in this issue we print the second list of acknowledgments of donations to the Headquarters Fund. It will be seen that the response has been excellent and that the target figure of £4,000 has been attained. The Executive Council, and in particular the Honorary Treasurer, are very grateful to all the members who have contributed, and it need only be said to those who have not yet done so, that the Fund is still open. Even if it should exceed the immediate expenses of the move it will assist in building up a necessary H.Q. reserve to cover both depreciation and to provide for future needs, and especially a new lease in ten years' time.

To move offices, as had to be done, during the peak of conference and exhibition preparations, is not to be recommended. Even now, at the time of writing, everything is not as finished and as shipshape as we intend. But the premises are at least ready for inspection and we shall be delighted to see any of our Fund contributors who would like to look round.

## The Photo Competition

The plans for the photographic competition, announced in our last issue, which was to have been run jointly by the Society and the *News Chronicle*, have unfortunately come to naught by the regretted ending of the newspaper. Alternative arrangements are at present being considered by the Society, but at the time of going to press no final decision has been made. Readers will remember the great success of the similar joint poster competition which the *News Chronicle* had made possible, and we are indeed sorry that such a fruitful—and friendly—collaboration has come to an end.



## SIR ERNEST SMITH

IT is with deep regret that we have to record the death, on November 8th, 1960, of Sir Ernest Woodhouse Smith, C.B.E., D.SC., F.R.I.C. Sir Ernest, who had been both President and Honorary Treasurer of the Society, will be remembered with affection and respect by the many who knew him. His interest in the Society dated back for many years—he was present at the 1929 conference at Buxton when the two older organizations amalgamated to form the National Smoke Abatement Society. It was not, however, until after the last war that his interest became intimate and active, when he did much (and inspired much) to ensure that the rapid post-war growth of the Society was on sound and steady lines, both in policy and in its finances. As Honorary Treasurer, and in part by his own personal appeals, Sir Ernest secured the larger contributions, mainly from the fuel industries, that made possible the growth of activities that was then being demanded.

In Council and Committees, Sir Ernest's wide knowledge and understanding of science and technology, of business, and above all of men, was always apparent, and he excelled in

combining a shrewd and penetrating appraisal of a problem with an understanding of the human factors involved. He appreciated frankness, could himself be outspoken, be both good-humouredly persuasive and firmly determined; and above all was a man whose wisdom and experience helped the many who sought his counsel.

Aged 76 at his death, Sir Ernest had been in ill-health during the past few years and had withdrawn from the public life, mainly in the world of fuel, that he so dearly loved. A Manchester University graduate, he was at one time Chief Chemist to the City of Birmingham Gas Department, and in 1920 became Technical Director to the Woodall-Duckham companies. During the last war he was for a period controller of gas supplies, and later became the first Chairman of the Industrial Coal Consumers' Council, a position he held with distinction until his final retirement. He gave great service to the Institute of Fuel, for which he had also been Hon. Treasurer and then President, in its progress to becoming one of our senior technological institutions.

" E.W.", as he was so often called, had also been a member of the Gas Research Board and of the Fuel Research Board and its Atmospheric Pollution Research Committee. In recognition of his services to the technical development of the gas industry he received the Birmingham Medal, the highest award of the Institution of Gas Engineers. Few men can have done so much, in so many different ways, for fuel technology—including the use of fuels without air pollution—as Sir Ernest Smith. The Society owes a great deal to him, and his name will be remembered with gratitude. A.M.

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## RONALD WILLIAMS

Many tributes have been paid to the life and work of Ronald Williams, O.B.E., whose untimely death on October 9th last was universally regretted. I would like to add mine.

I first met Ronald Williams when he came to the West Country in the early '30s. He moved from Salisbury to Bristol as a district inspector in 1935 and his energy and enthusiasm soon marked him for advancement. Successively he became specialist food and drugs inspector, and, in 1943, deputy chief public health inspector. He left Bristol in 1951 to become chief at Coventry.

Ron Williams tacked every problem confronting him with a confidence born of sound training and excellent technical qualifications. He inspired those with whom he associated to do likewise: and was intolerant of inaction and avoidable delay.

Interested in all phases of a public health inspector's work, nothing was more compelling to his initiative and drive than the cause of clean air. He often said his experiences in Bristol inspired his later work in the Midlands City which he served with such distinction.

He was a loyal supporter of the Association of Public Health Inspectors and the Guild, having served as chairman of the Association in the Western Centre during the difficult war years. At the time of his death he was a member of the Guild Council.

Ron Williams will be remembered for many things: as a writer, educationist, lecturer, and for his work on the Working Party formed to report on the training and recruitment of public health inspectors. In particular he will be remembered with gratitude not only by a host of public health inspectors who, as students, learned their job under his able tuition, but also by those who had the opportunity of working with him in the cause of public health.

My last remembrance of him was at the Clean Air Conference in Harrogate when we exchanged greetings on the steps of Royal Hall. His death a few days later was tragic in its suddenness. The profession he served so well is the poorer for his passing. F.J.R.

# *Address to the Conference*

## by

**Sir Keith Joseph, M.P.**

*Parliamentary Secretary, Ministry of Housing and Local Government*

In opening the Society's Harrogate Conference and Exhibition, October 5th, 1960

Mr. President, I am very honoured to have this opportunity of talking to this great conference today. I fully realize that most of the people here are experts and all are enthusiasts. During the 11 months that I have been a Parliamentary Secretary of the Ministry of Housing and Local Government I have had quite a lot of work to do connected with clean air. I started as a whole hearted believer and enthusiast for the cause. I remain an enthusiast and a believer in the cause but I am not yet, I am afraid, an expert. I know very well what a great expert your President Sir Hugh Beaver is. He can rightfully claim to have helped lay the foundation of the Clean Air Act. I know that the Society deeply regretted that owing to illness Sir Hugh was not able to attend its International Conference last year. We are all very glad to know of his recovery and that he is in the Chair this morning.

May I add a word of thanks and tribute to Sir Hugh who has, as long as I can remember, been a very kind and good friend to me personally, so that it is especially a privilege and honour to speak under his presidency this morning.

In the Clean Air Act, Parliament has provided us with the legislative tools for the job that has to be done. I am not claiming here that the Act is perfect, no Act ever is perhaps, but it does give the powers necessary to tackle the smoke menace. It is now four years since the Act was passed and the whole of it has been in operation for more than two years. It is therefore a suitable time to assess progress and consider future plans and prospects and I see with interest that you are devoting tomorrow to just this theme. It is the more relevant because during the past year there have been two important documents published. The Peech Report on Solid Smokeless Fuels and the Command Paper on Local Authorities' Smoke Control Programmes in England and Wales.

The Peech Report on Supplies of Smokeless Fuels was published in April. It presents on the whole quite an encouraging picture. The Committee found that in England and Wales the overall supply of smokeless fuels will so far as can be foreseen be adequate for the next five years after taking into account likely progress in smoke control and assuming there will have to continue to be a good deal of reliance on suitable quality open fire gas coke.

This does not mean that consumers will always be able to obtain the particular kind of fuel they prefer; in some parts of the country there may be shortages of premium fuels at times in the next three or four years, that is, unless production is expanded—a question which the producers have been asked to consider in the light of the report. But as you will all remember, the Beaver Committee always envisaged that to a large extent progress in domestic smoke control would depend on coke. The Gas Boards have done a great deal to improve the standards of gas coke produced for open fires and many are now producing it to the new British Standard Specification, the existence of



*Sir Keith Joseph addressing the Conference*

which is a real step forward. Gas coke of this sort is undoubtedly an economic and efficient fuel for the domestic open fire, and I hope that any lingering prejudices against it will soon be a thing of the past.

In one part of England, the north-east, the Peech Committee Report did suggest that unless steps were taken, a shortage of open fire coke might develop and consequently the Ministry of Power are now looking into the situation there in conjunction with the Coal Board and the Area Gas Board to see what can be done.

Now I pass to the Command paper. Many of you will already have seen copies of this setting out local authority smoke control programmes. Those of you who have not can buy a copy from the Department's stand at the exhibition, where you can also see some of the information from the Report shown graphically on maps in the Department's exhibit, and I won't go therefore too much into detail. But I should like to draw attention to the main points that emerge from this Report. And I apologize now for giving just a few figures.

By the end of 1958 some 120,000 premises and 17,000 acres in the black areas of England and Wales were in smokeless zones or covered by smoke control orders. The black area authorities submitted estimates indicating that they hoped to cover a further quarter of a million premises and nearly 50,000 acres by Orders made during 1959, and that progress in 1960 (nearly half a million more premises and over 100,000 more acres) would be double that in 1959. The programmes envisaged that something near the 1960 rate—that is a rate of half a million more premises and over 100,000 more acres—would be maintained in each year up to 1963, which would mean some $2\frac{1}{4}$ million premises including two million houses and nearly half a million acres in the black areas being covered by Smoke Control Orders by the end of 1963.

The actual rate of progress, Mr.

President, in 1959, nearly 150,000 premises and 20,000 acres covered by Orders submitted during the year, was unfortunately considerably less than the estimates; but even so the areas covered by Smoke Control more than doubled during the year of 1959.

Orders submitted in the first eight months of this year 1960 covered nearly 160,000 premises and 30,000 acres, which suggests that 1960 may see the 1959 figures again doubled. Although this would still not catch up with the original estimates it does look as though the acceleration towards the peak rate is continuing fairly well. Once the peak is reached, and provided the momentum can then be maintained, it seems likely that, over much of the black areas, authorities will have got over the " hump " of the job by the end of the decade. If all goes well, the greater part of the County of London should be covered by Smoke Control Orders by then. This is not bad going.

On the other hand, a disappointing feature of the Report was the rather large number of authorities in areas provisionally listed as black who did not submit programmes at all. Taking a general view I think we may say that, while the programmes do not present a picture which is entirely satisfactory in all respects, they do underline the number of black area authorities who have given most serious consideration to their clean air responsibilities, and who plan to free themselves from smoke as fast as they can.

We have recently, Mr. President, asked the black area authorities to review progress made in planning and executing the programmes of domestic smoke control necessary in their areas. We hope that some authorities who have not drawn up programmes will now be encouraged to do so by the excellent example of their neighbours. We look forward to a bit of regional rivalry in this.

Perhaps also some authorities, who originally planned a slower rate of progress than those of other authorities in the area, will be encouraged to revise their programmes to bring them more into line with those of their neighbours. For our part we will do all we can to help in removing difficulties.

In particular we are anxious to avoid creating delays in the handling of smoke control orders, either in the department or at the local authority end. Recently a spate of objections, not entirely spontaneous, to a series of orders caused additional work in the department and we got a little behind, but I think we are getting over that now. Meanwhile we are seeing whether the administrative procedures we require from local authorities can be simplified. At the moment we are consulting the local authority associations about the possible abolition, in the majority of cases, of the present requirement that an authority has to submit preliminary details and obtain approval in principle before making an Order. Other possible ways of simplifying procedure are under consideration within the Department.

We recently issued to local authorities in question and answer form some material suitable for reproduction for publicity purposes, hoping that this might simplify the work of local authorities by providing them with a basis for their own publicity when they are making orders. The circular has proved quite a best seller and has gone into a second printing. We hope that suitable use of this material may decrease objections to orders and thus help to keep things moving quickly.

Before I leave the subject of local authority smoke control programmes, I should say that I have read with interest the report of the address by your Director at Aberdeen, in which he suggested an abandonment of the concept of black areas in favour of a graduated priority classification of conurbations, large towns, small towns, and rural areas.

This is a stimulating idea, but may I say that it is not so far removed from the present position as may at first sight appear? In listing local authorities whose areas appear to be black in whole or in part the Minister was

merely indicating to the authorities concerned that they appeared to have a *prima facie* need for systematic smoke control.

There may well be areas outside the listed black areas where a systematic approach to more localized domestic smoke problems may be needed. The Minister will consider smoke control orders made outside the black areas on their merits. A number of smoke control areas made by authorities whose areas are not listed as black have already been confirmed.

The concept of black areas is essential in order to co-ordinate the attack on the worst areas of pollution, but it is not the intention arbitrarily to divide the country into black and white. There may be numerous " grey " areas where there is a case for smoke control.

Incidentally, as regards the smoke measurements cited in Mr. Marsh's address, I may say that there never has been a scientifically based national survey of smoke pollution in this country. Our present information is based on measurements made by local authorities and many local factors affect the siting of the gauges. One authority may only have instruments sited in what it regards as its worst polluted area or areas; another may have a more even spread of instruments so as to give a truer picture of pollution in the town as a whole. Obviously measurements from such differently sited instruments will not give comparable information for the towns concerned.

A working party representing interested local authorities and the Department of Scientific and Industrial Research has in fact been drawing up a plan for a scientifically based national survey of pollution. I very much hope that this will prove acceptable to the authorities who participate in the co-operative scheme



*Inspecting the Exhibition. Left to right: Sir Keith Joseph, Dr. Burnett, Sir Hugh Beaver and the Mayor of Harrogate*

for the measurement of air pollution, and to any other authorities whose co-operation may be asked for.

The Department of Scientific and Industrial Research distribute to local authorities who participate in the present co-operative scheme for measuring smoke a monthly annotated bibliography and other reports. This material should keep them in touch with the latest developments in air pollution research. It may be, though, that the material should reach more local authorities than it does now, and this is something which is being gone into at present.

I have spoken mainly about the responsibilities of the local authorities, and, in particular, to the attack which they are making against domestic smoke, since this seems a very suitable moment to bring under review the progress and prospects in this field.

Here, in this domestic section, we know the enemy, and we know just how to set about defesting him. What, above all, is required is zeal in carrying on the battle and effective staff work in planning and executing the campaign.

The campaign against industrial smoke presents difficulties of a different order. In some important parts of this field the most effective means of fighting the battle have still to be worked out and new weapons forged. These tasks are being tackled energetically and systematically by the Alkali Inspectorate, whose long and honourable record in combating air pollution is well known to members of this Society. I can report that there are grounds for sober optimism that the major technical problems posed by the processes which became the responsibility of the Alkali Inspectorate under the 1958 Alkali Order will eventually be solved.

The steel industry offers a good illustration of the highly technical problems which the Inspectorate are engaged in tackling. That industry is undergoing a technical revolution with the introduction of large scale use of oxygen in various processes and the resultant fume problem presents formidable difficulties. Preventive measures can be very costly—for the largest works they may go into seven figures. The Minister, however, is determined that reasonable preventive means shall be installed in this and other industries as and when they become technically effective, and it is only right that I should record the readiness of industry to accept the need for clean air and to accept the need for expenditure—often heavy expenditure—to achieve clean air.

Finally, I may say that both here and in the United States the responsible bodies are much concerned with the problem of pollution from motor vehicle exhaust gases. I see you are discussing this this afternoon. Detailed information about the steps being taken in California to deal with exhaust gases from petrol engines has been obtained and is being most carefully studied.

Some of the special measures being taken in California to deal with petrol engine exhaust gases are necessary because of the peculiar climatic and other conditions there; similar conditions are very rarely found in this country. At the moment the Americans are attempting to develop suitable devices for minimising pollution from petrol engines, and we in this country shall be very interested to see what progress they make in this field.

Surveying the whole field of clean air, I think we can say that the achievements of the past year have not been insignificant. Moreover we have a clearer idea of the work which lies ahead, and of the time required to accomplish it. However, there are forms of air pollution about which, through no fault of our own, we still know too little to tackle effectively. One is sulphur pollution. It is unfortunately true that in spite of an active programme of scientific research in this country, supported and co-ordinated by the Government, and in spite of our keeping in touch with research in other countries, we still know all too little about the effects of sulphur pollution and how to prevent it. So far there are few indications that the scientists are near a break-

through, but they will go on trying. Their efforts are by no means confined to the single problem of sulphur. They are trying to increase our knowledge of air pollution problems over a very wide field besides, ranging from medicine to industry and from shipping to agriculture. You have a session, I see, on all this research. I consider their work of the greatest importance. As our knowledge increases and our techniques improve we will be able to make further advances towards clean air.

You are, of course, all familiar with the various reasons which make the achievement of clean air such a compelling necessity. Of these, I think the health reason is the most important. Since the middle of the nineteenth century we have successfully dealt with most of the public health problems associated with the early industrial revolution. Contaminated water supplies, non-existent or inadequate sewerage, bad housing, are no longer the widespread health hazards they once were in our towns. But dirty air is one legacy of the past which is still very much with us, and is still a serious threat to health. It will surely be an outstanding improvement in environmental health if in the years ahead we succeed in cleansing the air in our cities and towns.

Hardly less important is the relief that clean air will bring to the women of the black areas. They will no longer have to spend so much of their lives washing, scrubbing and dusting the same things over and over again to keep the grime and grit at bay. Clean air is one of the biggest and cheapest labour-savers for the twentieth-century housewife and I should like to see housewives in the black areas getting together and demanding clean air, and freedom from unnecessary drudgery, as fast as possible.

This will all have to be a joint effort —local authorities, industry and the Government each have their part to play. The public too, and especially the housewife, must be convinced of the value of clean air—here some international stress is very relevant—and must be prepared to accept the changes it may involve.

The National Society for Clean Air has already done much to mobilise opinion in favour of clean air, and I hope they will long continue to do so.

Mr. President, I have the very greatest pleasure in declaring this Conference and Exhibition open.

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**Smoke Control and Town Planning**

" The progress report on smoke control just published by the Ministry of Housing is a melancholy document. It is quite clear that most local authorities have fallen a good deal behind in their programmes, most of which in any case only aim at completion in the 'seventies. . . . The Minister, as master planner, has made it clear that the Government means to defend the green belts, and it seems likely that this will be done by encouraging the renewal, possibly at higher densities, of existing worn-out built-up areas—the ' twilight zones '. . . . But this revitalization of the living areas of the towns and, indeed, the renewal of their central areas all depends on quick action to clean the air. People will not put up indefinitely with the present dirt and grit and if it is not remedied they will clamour to move out. The resulting urban sprawl will make nonsense of the Minister's new policy and much else besides.

" We suggest that the Minister's left hand has urgent consultations with his right and that he considers the introduction of legislation to make smoke control obligatory instead of permissive."—*The Architect and Building News*, 24 August, 1960.

# IMPRESSIONS OF THE CONFERENCE

*(Contributed by a Delegate)*

NEARLY a thousand clean air enthusiasts crowded into the Royal Hall, Harrogate, on the opening morning of conference, bent on gleaning some useful knowledge from the experts who were to speak during the week.

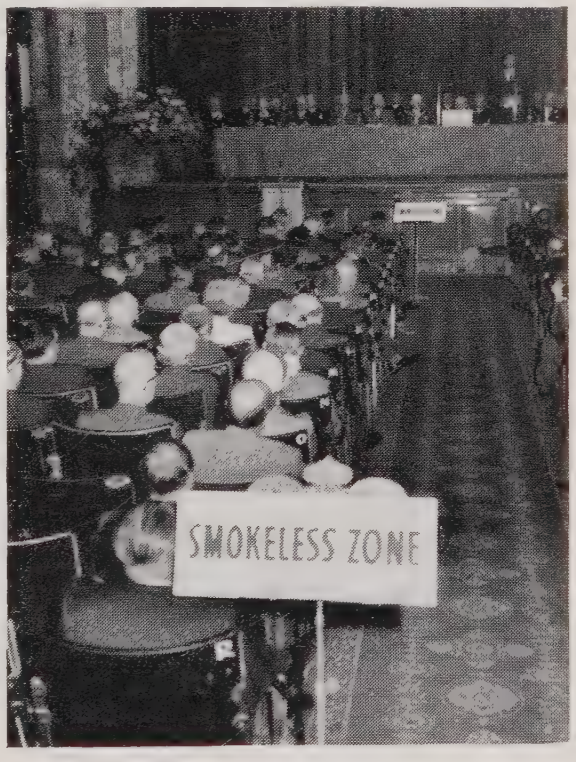
As is usual at these events, Civic Pomp and Circumstance took pride of place. His Worship the Mayor welcomed delegates with a discreet and well-timed speech. Pleasantries over, conference got down to more serious business when Sir Keith Joseph, M.P., Parliamentary Secretary to the Ministry of Housing and Local Government, spoke before declaring conference and the exhibition open. Playing on a home pitch (Sir Keith is M.P. for Leeds N.E.), the speaker urged that clean air was one of the biggest and cheapest labour-savers of the twentieth century. Dirty air was a legacy of the past and remained a serious threat to health. He thought that housewives in "black" areas should demand clean air and freedom from drudgery.

There seems to be a tendency to overdo this differentiation between "black" and "white" areas in relation to the clean air campaign. This is a tactical mistake. They might well develop into "do" and "don't" areas. It is useless to ignore the fact that many local authorities have done nothing to rid the atmosphere of domestic smoke; banking on the fact that they are in a "white" zone.

Sir Hugh Beaver, giving his Presidential Address, expressed some diffidence over its content. He said: "I have long since, I think, said everything that I have to say, at least that I have thought worth saying." Sir Hugh need have felt no diffidence. His speech focussed attention on past and present action taken in this country and elsewhere to clean up the atmosphere and showed that he had not run out of talking points.

Wednesday afternoon was given over to discussing air pollution from road vehicles on papers submitted by four speakers. Mr Lister (Northumberland C.C.), well known for his research in this field, made us realize how ineffective is the present law to deal with smoke from moving diesel vehicles. I would also add to the list the pre-war "jallopies" which seem to run on a mixture of crude oil and tar!

Mr. Waring, from Leyland Motors Ltd., said that poor combustion causing smoke resulted from a number of factors, including interference with the air breathing of the engine. Drivers overfed the engine to obtain greater power output. How right he was! Who has not been caught behind one of these monsters somewhere on a steep hill with no means of overtaking and having to breathe a




*Smokeless Zone in the conference hall—a popular new idea for the benefit of non-smokers*



*Social occasion—M. Henri and Madame Perdon, from France, with Dr. J. S. G. Burnett*



*Dr. J. Pedrerol from Barcelona, with Dr. K. Lenhart, West Germany*

cloud of filthy exhaust fumes belched from the engine!

The De Voeux Memorial Lecture on Thursday morning was delivered by Sir Linton Andrews, a distinguished journalist and editor of the *Yorkshire Post*. His style of writing and manner of delivery were most enjoyable. Sir Linton dealt with his subject, with the skill expected of a newspaperman. He devoted some time to explaining those factors which help to crystallise public opinion before discussion how publicity could be used to further the cause of clean air.

Referring as an instance to papers published by the Society on the development of smokeless fuels and quoting Dr. Bronowski's fine contribution to conference a year or so ago, the speaker said it had not received the prominence which it deserved in a journalism " in which it has to compete for public interest with murder mysteries, film star scandals and tragic accidents to sporting celebrities " (not to mention *Lady Chatterley's Lover!*).

One might ask who is to blame for this—the Press or the public? Things will not improve while sensationalism is preferred to sense.

In passing, it is worthy of mention that conference received a fair measure of publicity in the newspapers, both national and local. The *News Chronicle*—alas since engulfed in the maws of a competitor—really went to town with features and pictures. (One was of a young lady with shapely legs admiring " clean air " grates. The grates weren't bad either!)

On the same morning there was a discussion on a series of technical reports on Progress and Research in relation to clean air. Fourteen authors, each an expert in his particular line of business, contributed a paper which was not read but left for discussion. I think this arrangement was a mistake. It was too much for delegates to absorb on top of the De Voeux Lecture. Cramming a quart into a pint pot is never successful no matter how one tries.

The remaining sessions were set aside for an inquiry into the working of the Clean Air Act. This was something to which many local authorities had contributed by answering questionnaires sent out by the Society



*One of the many attractive stands in the Exhibition*

earlier in the year. The results were collated in appendices to papers submitted on the domestic and industrial aspects of the inquiry.

Without detracting from what had gone before, I considered these sessions were most helpful, certainly to local authority delegates who were in the majority. The encouragement which they could derive from this review ought to influence their reports to their own local authorities to ensure that purging the atmosphere of smoke and smog shall continue to a successful end.

On Thursday evening, delegates thoroughly enjoyed themselves at the reception given by His Worship the Mayor and Mayoress. As an interlude to the dancing, two leading London exhibitionists, Pat Lane and June Carlisle, showed the company how the "Light Fantastic" should really be danced. The lady partner was most attractive in an *ensemble* of pink and black.

A word or two about the exhibition. It was well organized and laid out. The exhibitors had every reason to be satisfied. Certainly the place was thronged every time I walked around.

An appliance which aroused great interest was a smoke-consuming rubbish furnace which really was smokeless with a capital "S". Burning rubber tyres in the centre of Harrogate Spa is not a pastime likely to commend itself either to the Corporation or Mr. Dodsworth: but they were being burnt in this furnace without the slightest trace of smoke (except when the operator created it temporarily in order to show the efficiency of the furnace).

*Verdict:* A successful and useful conference, for the organization of which, everyone concerned can be congratulated.

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**Clean Air Council.**—New appointments announced are: M. L. Mather, chairman, Mather & Platt Ltd., and a member of the N.S.C.A. Executive Council; E. H. Browne, Deputy Chairman, N.C.B., and Alderman Mrs. W. Shutt, City of Leeds.



*F. J. Redstone, Past-Chairman, Dr. J. L. Burn, Deputy Chairman, and J. J. Matthews, Chairman of the Conference Committee*



*All together!—L. P. Draper (oil), W. D. Jarvis (electricity), and D. M. Maddocks and Dr. F. J. Eaton (gas and coke)*



*Alderman F. W. Perry of Smethwick with S. N. Duguid, Past-Chairman, both of whom were also present at the inaugural conference of the National Smoke Abatement Society at Buxton in 1929*



*The Conference in Session*

**" Helpful Papers "**

" It would be foolish of road transport operators to resent the action of the National Society for Clean Air in devoting one session of this week's Clean Air Conference at Harrogate to discussing the question of black smoke emitted by the exhausts of diesel-engined road vehicles.

" It was not an unpardonable intrusion into other people's affairs, as some would represent it to be, nor was it part of any fanatical anti-motor vehicle propaganda campaign. It was a genuine attempt to pool as much information as possible so that what has become, let us admit, a serious nuisance on the highways of the country may be ended. In a spirit of helpfulness the Society enlisted recognized experts from inside and outside the industry to put their knowledge at the disposal of all, and invited representatives of road transport operators to attend and join in the discussions." —*Motor Transport.*

**Package Coke Experiment**

Following the installation of £5,000-worth of machinery at Foleshill Gas Works, housewives can now buy coke ready packed in 28 lb. bags. Eight towns in the area have been chosen by the West Midlands Gas Board as a testing ground for the experiment. The scheme means that coke will be available for domestic consumers at gas showrooms and service centres in Coventry, Leamington, Warwick, Rugby, Hinckley, Nuneaton, Stratford-upon-Avon and Atherstone. Launching the new packaging on 1st November, Mr. D. Maddocks, Area Coke Officer, said that the Warwickshire Division of the Board was being used to experiment before the Board as a whole adopted the new step. One of the main reasons for using the Division was that the Coventry Area was one of the most advanced in the country with clean air zones. Another reason, he said, was the enormous number of cars in the area, The Board hoped that the public would find the bags convenient and easy to carry in the boot of a car.

# *A National Survey of Air Pollution*

## Minister Welcomes Proposals

THE Standing Conference of Co-operating Bodies on Air Pollution, convened by the Department of Scientific and Industrial Research, met in London on 14 November, 1960, under the chairmanship of Mr. Norman Bastable. The meeting was opened by Mr. Henry Brooke, the Minister of Housing and Local Government, who said that he welcomed the proposals that were to be put forward for a national survey of air pollution. These proposals, made by a working party of the Standing Conference, were considered later in the meeting, and must be regarded as the most important development for many years in the investigation of air pollution.

In the course of his address Mr. Brooke said: " The more importance one attaches to measuring air pollution, the more important of course it is to establish the best system of measuring it.

" I believe that the present co-operative system has grown up over many years in rather a haphazard fashion, as individual local authorities or others became interested in the subject and applied to join the co-operative scheme and to take measurements.

" It would be wrong to assume that the measurements at present taken are necessarily representative of urban areas generally. Quite a number of towns in the black areas and even some large cities do not take any air pollution measurements.

" There is a good deal of variation even in the places where measurements are taken. In some towns the local authority has tried to obtain a comprehensive picture of pollution over the town as a whole. In others it has concentrated its measuring instruments in the areas which it suspects to be most polluted.

"All sorts of local considerations have affected the siting of instruments in each town. For these reasons measurements from different towns may not be comparable.

" I believe too that under the present system many authorities are taking measurements for primarily local purposes, and from the data they provide we can hardly obtain a completely true picture of pollution trends over the country as a whole. As we make progress, our requirements change.

" We have now certainly reached a stage where we need some national standard by which the results of all these local measurements can be judged. I am very glad that the working party originally set up by this Conference has been preparing recommendations for a national survey of air pollution to be made on a more systematic basis.

" You will not expect me to comment here and now on the detailed recommendations of this working party. But I have come here to say that in principle I welcome the idea of a national survey.

" Whatever you may decide on the details, I hope that the members of the Conference will accept in principle the desirability of having a national survey, and that if their own local authority is asked to co-operate in the survey they will give their full support.

" The aim of this national survey is to provide the objective standard we need by which we can judge the progress made towards clean air

throughout the country. To get at this, measurements must be taken by a representative sample of towns in various categories."

After considerable discussion the report proposing the scheme for a national survey, based on selected sites in a statistically representative number of towns, was accepted by the Conference. The report, giving the reasons for the scheme and the principles on which it will be operated, has not yet been released for publication by the D.S.I.R.

## ACTION AGAINST DIESEL FUMES

The Minister of Transport is proposing to prevent by regulation the misuse of excess fuel devices on diesel-engined road vehicles by amending the Motor Vehicles (Construction and Use) Regulations by inserting:

> (Regulation 21A): where a motor vehicle, being a vehicle propelled by a compression ignition engine, is fitted with a device which facilitates the starting of the engine by causing it to be supplied with excess fuel any apparatus by means of which the device is operated shall be fitted in such a position that it cannot be operated by the driver of the vehicle while he is driving.

It is pointed out by the Ministry that improper resort to the cold-starting device is only one cause of excessive exhaust fumes.

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## SCIENTIFIC STUDIES

**Atmospheric Diffusion and Air Pollution. Edited by F. N. Frenkiel and P. A. Sheppard. 471 pp. Academic Press, New York and London.**

This volume is the proceedings of a symposium held at Oxford in August 1958 by the International Union of Theoretical and Applied Mechanics and the International Union of Geodosy and Geophysics. The title indicates the specific theme of the symposium, at which nearly 50 papers were presented. The behaviour of air pollution in the atmosphere is of course one of the most important aspects of the scientific study of the problem and a great deal of work is being done upon it. Here it is examined in detail by the physicists and the mathematicians, and the papers make a notable contribution to the theoretical understanding of a complex of factors that are involved which, at a later stage may have much practical importance.

**Aerodynamic Capture of Particles. Edited by E. G. Richardson. 200 pp. Pergamon Press, Oxford. 50s. net.**

This book is the report of another symposium of a scientific character that has an important bearing on the study and control of air pollution. The conference was held at the British Coal Utilization Research Association, Leatherhead, Surrey, in 1960, and the report falls into three sections: Theoretical and Fundamental Aspects; Experimental Application of Capture Techniques; and the capture of particles by raindrops.

### For Architects and Builders

Technical rather than scientific, a series of ten supplements by the Gas Council first published in the *Architects' Journal* has been reprinted in attractive form as the **Gas Handbook for Architects and Builders.** The material is detailed and strictly practical in character and provides all the information that an architect or builder is likely to need in planning and installing gas installations. Coke as well as gas included wherever it is appropriate. Domestic space heating, by fires or unit heaters, central heating and water heating are covered, as are gas flues, and appliances and flues in tall buildings. There is a chapter on coke itself, and other aspects reviewed are the domestic kitchen, catering, installation of gas, and communal laundries.

# QUESTIONS IN PARLIAMENT

**Smokeless Fuels**

**Mr. W. J. Owen** (Lab., Morpeth) asked the Minister of Power what steps are being taken to ensure adequate supplies of smokeless fuel during the winter; and whether he will make a statement.

**Mr. J. C. George** (Parliamentary Secretary, Ministry of Power): Although there is always the possibility of local shortages of particular fuels, no serious shortages are anticipated. Stocks of solid smokeless fuel are about the same as last year, and coke supplies in particular are abundant.

**Mr. Owen:** Some retail merchants do not share the Parliamentary Secretary's optimism. Is he aware that in some areas there are less than two weeks' supply in the stock yards? We are approaching what might be a severe winter. Is it true that there is a bottleneck in supplies, or is transport the problem? Will the hon. Gentleman be good enough to have a look at the problem and take urgent action?

**Mr. George:** There is always a possibility of local shortages and of differing local tastes making demands upon particular brands of smokeless fuel. My Answer was that in general there are ample supplies to face this winter. Railway and other difficulties may crop up, but, in the opinion of my right hon. Friend, there are ample stocks in the country to meet the demands likely to be encountered this winter.

**Mr. Dodds:** As the Minister has just made an optimistic statement, can he give an assurance to people living in North-West Kent and South-East London, who last winter had to wait from 4th December to the first week in February for coal to be delivered? Are we to take it that, with short stocks on the ground in those areas, there will be no difficulty all through this winter in the delivery of coal by rail or road?

**Mr. George:** The hon. Gentleman is under a misapprehension, The Question refers to smokeless fuel.

**Mr. Mason:** When a smokeless zone is declared, the general impression created is that coal is a banned fuel. Is it not up to the Ministry to intervene and try to secure better liaison between local authorities and the National Coal Board so that, when a smokeless zone is declared, adequate supplies of smokeless fuel are readily available?

**Mr. George:** No smokeless zone is allowed to be created before authority is given by the Ministry of Power. Authority is not given until local committees, composed of distributors and producers, have been consulted. On no occasion has authority had to be refused because of shortage of supplies.

**Smog**

**Dr. A. Thompson** asked the Minister of Health whether, in view of the abnormally high incidence of chest and heart cases in industrial areas of Great Britain, he will give immediate consideration to measures to protect the health of citizens from the effects of smog in the forthcoming winter.

**Miss Pitt:** Yes. Facilities for the care and protection of persons liable to suffer in smog conditions will be available under the National Health Service including the provision of special masks. Warning and advice will be broadcast by the B.B.C. when persistent fog is expected.

**Diesel Fumes**

**Mr. N. N. Dodds** (Lab., Erith and Crayford) asked the Minister of Health as representing the Minister for Science, if he will give details of the experiments carried out on behalf of his Department which show that diesel fumes are not endangering health.

**Mr. Powell:** Investigations into the effects on health of diesel exhaust fumes form part of the programme of research on air pollution undertaken by the Medical Research Council. They have included statistical studies on a large group of patients with lung cancer, which showed that in this group there was no greater proportion of persons who might have been expected from the nature of their employment to have greater exposure to vehicle exhaust fumes; and a study on London Transport employees, in collaboration with the Chief Medical Officer of London Transport, which provided no evidence of significantly greater mortality from lung cancer among men working in diesel bus garages. Analyses of the air in bus garages and busy streets have shown that motor exhaust fumes are only one of many pollutants and that their content of benzpyrene, a known cancer producing agent, is very small in relation to the total amount in the atmosphere from all sources. Even in congested spaces such as vehicular tunnels, pollution from exhaust fumes has been found to be no greater than the pollution of an urban atmosphere by coal smoke on many winter evenings. It seems reasonable, therefore, to deduce from these findings that diesel fumes are not endangering health.

# INTERNATIONAL SECTION

*Western Germany*

## PARLIAMENTARY INITIATIVE FOR THE PREVENTION OF AIR POLLUTION IN GERMANY

***Dr. O. Schmidt***

*Member of the Federal Parliament, President of the Interparliamentary Working Community, Bonn, Germany*

THE extent to which the Interparliamentary Working Community, to which approximately 300 members of all parties of the Parliaments of the Federation and of the Laender belong, has devoted itself to this complex of questions can already be gathered from the Proceedings of the London International Clean Air Conference 1959*.

After exhaustive discussions in the Committees, the Draft Bill (fully described therein) concerning air pollution and the production of noise by industrial enterprises was unanimously approved with minor amendments by the Plenary Assembly of the Federal German Parliament, and promulgated in the Federal Law Gazette on December 29th, 1959. It became fully effective on June 1st, 1960. The Bundesrat approved the first Statutory Decree for the Implementation of this Law, and it was promulgated in the Federal Law Gazette on August 4th, 1960. This laid down in the form of an extensive catalogue the installations used for industrial or mining purposes, or used in the operation of economic undertakings, which are subject to obligatory control.

It should be mentioned in this connection that, as a result of another motion by Members of the Federal Parliament, the setting up of installations directly serving the purification of air has been treated favourably under the Income Tax Law since spring 1958. The Members of the Interparliamentary Working Community have submitted a Draft Bill to the Federal Parliament in good time, so that this law, which is due to expire at the end of 1960, can be prolonged for five years. The Federal Parliament approved this suggestion as well, in combination with a tax bill moved by the Government prior to breaking up for the summer recess in July, 1960.

Since the Deputies concerned were well aware of the fact that, while substantial progress could certainly be achieved by these laws, other parts of the operational field also required regulation, they simultaneously tackled further preliminary work.

In an action directed at getting the provisions required to limit the exhaust gases and noise produced by motor vehicles incorporated in Road Traffic Legislation, Members of all parties in the Federal Parliament put forward appropriate proposals within the confines of a Minor Interpellation on November 20th, 1959. The Federal Minister of Transport has incorporated these proposals in a Decree which has meanwhile entered into effect with the approval of the Bundesrat. This not only ensures—among other things—constant control of motor vehicles, but also extends such control to the development of exhaust gases. Renewed presentation of the motor vehicle is to be demanded already on suspicion of a contravention of the regulation, and the noise level values

* O. Schmidt, II. 17, page 48.

are to be entered in the motor vehicle licence.

Another Initiative Bill has recently been put forward, also from the ranks of the Bundestag, which may perhaps lead to a decisive improvement in conditions. A Draft Bill has been submitted to the Federal Parliament under Printed Matter 1980, the object of which is that liquid and gaseous fuels shall be placed on the market with a minimum content of sulphur. This would for the first time affect also a part of the fuel for domestic consumption, but further provisions by the Land Legislators would be required for this purpose. It will above all also be up to the manufacturers to sell only such coal stoves as will largely ensure preservation of atmospheric purity.

It is to be hoped that, as a result of all these measures and the technical progress made, the situation with regard to preservation of atmospheric purity in the Federal Republic will have improved substantially in a few years' time. A positive reply to the three following questions is, however, a pre-requisite:

1. Does the population regard this complex of questions as being of such importance that it will also fight for better air on the basis of the legal foundations created?
2. Are the interests affected sufficiently open-minded and sensible to try to do away with such sources of pollution of their own accord?
3. Will the authorities be willing and in a position to act with determination if this is required?

The ultimate success will thus depend on the collaboration of extensive interests. The Deputies have achieved a clarification of the most essential questions of law, and created a legislation which is at the same time modern and adaptable, and they will continue to supervise its implementation by means of the controlling powers of Parliament.

(*An English translation of the Decree scheduling the industrial installations requiring a permit, discussed above by Dr. Schmidt, may be seen at the Society's offices, or photo-copies will be made and supplied on request for a fee of* 6*s.—Ed.*)

## AIR POLLUTION INTEREST IN THE NETHERLANDS

***Professor Dr. J. W. Tesch (T.N.O.)***

Until 1950 in the Netherlands the problem of air pollution was not recognized as important. As usual the first interest was initiated by complaints of some parties directly concerned (especially bulb growers). Since scientific workers and public health people started to occupy themselves with the problem, and more facilities regarding air pollution measurements were established, general interest in this field is growing.

Since 1949, in Rotterdam, there has been a " Soil, Water, Air Committee," on which several Departments of the Municipality such as the Water Board, Public Health Department, and the Department for Control of Wares and Nuisance, are represented. Co-operation with local industries (for instance big oil refineries, fertilizer and power plants) in order to reduce and to prevent air pollution is very efficient. Considerable contributions to the study and control of air pollutants have already been made.

The Research Institute for Public Health Engineering, T.N.O., started its activities in this field in the early fifties. (The Research Organization T.N.O. as such can be compared with the whole of D.S.I.R., M.R.C. and private research councils in the U.K.) It has already promoted the quantity and the quality of measurements in co-operation with many institutes, and is now engaged in epidemiological studies.

On the initiative of the Central Organization of T.N.O. a broadly

based Committee for Air Pollution was initiated in 1956, in which all interests concerned and the various inspectorates are represented. It has set up one local contact group (New Waterway area, Rotterdam to Hook) and a scientific committee for the co-operative study of the influence on human health, animals and plant life, of measurement techniques and technical prevention.

In 1954, in the area of IJmond (the industrial area on the borders of the North Sea Canal, IJmuiden, west of Amsterdam) a special local committee was set up as a result of complaints from the bulb growers. The interest focused on damage to tulips and gladioli due to production of HF and $SO_2$ by the local iron and steel works. Fumigation experiments and field observations showed that damage was mainly due to HF. It was possible to compile a list of most susceptible varieties of flowers not to be grown in this area.

On the other hand the industry took technical measures for prevention, including the use of low-sulphur fuel oil or coal during periods of critical wind direction; the replacement of fluorspar by bauxite in steel furnaces to prevent fluorine emission; the erection of high stacks to diminish gas and dust concentrations in the field; the installation of venturi scrubbers to wash-out iron oxide dust and gases; the cleaning of greenhouses and other measures of minor importance.

All the time good co-operation was maintained between the industry and the organizations representing those who sustain the damage by the formation of a round table conference, which was attended a.o. by the independent T.N.O. Research Organization and the Royal Meteorological Institute. This appears to have achieved the conditions for reaching satisfying results: in 1958 no damage to plants could be found anywhere.

Danger to the health of the inhabitants seemed practically absent, although we have insufficient knowledge of long-range effects of low levels of dust and gases such as $SO_2$ and HF.

Within the Benelux framework contact was started in 1954 when Dutch workers were invited to an Air Pollution Symposium in Antwerp. Recently the Royal Dutch Chemical Society and her Belgian counterpart organized in Rotterdam a combined conference on Water and Air Pollution.

To the reader it may be a pleasant surprise that recently a Dutch weekly on economic affairs contained an article stressing the need for interest in the biological disadvantages of modern industrialization. Urgent attention was called to the need to incorporate biological (public health) expert knowledge in planning further industrialization. In the transition from a natural to a technological culture-pattern it is necessary to consult Pasteur and Darwin in order not to create a " biological monstrum."

*United States and Canada*

## POLLUTION IN THE DETROIT RIVER AREA

The Detroit River, between lakes Huron and Erie, is part of the Canada/U.S.A. boundary. It is the centre of a large industrial district, which includes the cities of Detroit and Windsor, and which suffers from considerable air pollution. The river itself, open for eight months of the year, carries much shipping traffic—28,000 passages in a year. The ships are mainly " canalers," but with the opening of the St. Lawrence Seaway an increasing use by ocean-going vessels is being found.

The smoke and fly-ash from this shipping has been the cause of much complaint and in 1949 the U.S. and Canadian Governments instructed the International Joint Commission to investigate and report on the air pollution problem, and in particular to determine to what extent the river vessels were contributing; what other factors were responsible; what preventive measures should be taken; how much would they cost, and by whom should the cost be borne.

The International Joint Commission have now issued their report (May, 1960). A summary of the investigation, with conclusions and recommendations, is given in a ten-page quarto booklet, while the full report is contained in a substantial volume of 241 pages.

Despite the attention directed to the river traffic the Commission finds that only 1·5 per cent. of the solid fuel burned in the area is used by the vessels in transit, but that this pollution is centred on the narrow belt adjoining the river. The bulk of the pollution is distributed over the 900 square miles of the area. The *daily* rate of emission in 1956 over the area was estimated to be 4,000 tons of gases such as sulphur dioxide, nitrogen oxides, etc., and 1,270 tons of solids. The extent of pollution in different parts of the area was measured and investigations were made into its effects on health and vegetation, and on the economic costs. The report stresses the importance of clean air for a vast programme of reconstruction and rehabilitation of the downtown district of Detroit, with new buildings and park and landscape development.

The flow of pollution across the international boundary is examined and reported upon: the prevailing wind causing pollution from the United States to invade Canada more frequently than the other way round. "During the navigation season this transboundary flow is augmented by the emissions from vessels. It is clear that air circulation across the boundary is such that any substantial source of pollution on either side is a matter of concern to both countries."

On the pollution from vessels the report states that there has been a major improvement since 1952, when a voluntary smoke control programme was put into effect. The smoke and fly-ash is mainly from ships with hand-fired boilers, and although the introduction of diesel and oil-fired equipment is gradually making improvements, it is pointed out that 37 per cent. of the Canadian vessels are over 30 years old, and 50 per cent. of the U.S. vessels are more than 45 years old. "Vessels of European registry are playing a significantly increasing part in Great Lakes commerce," but "this foreign fleet is a relatively modern one since most of the vessels are less than ten years old and about 80 per cent. are powered by diesel engines."

With respect to atmospheric pollution originating from sources other than vessels, the Commission finds that there is adequate legal and administrative authority in each country to enforce proper control, but that with regard to pollution from vessels the existing legislation is too limited, and that consideration should therefore be given to additional legislation by each country.

The recommendations on this, in summary, are that no smoke of Ringelmann shade No. 2, or darker, should be permitted except for periods aggregating not more than four minutes in any thirty minutes. For handfired vessels, for an interim period, no smoke of Ringelmann shade No. 2 should be permitted, except for periods aggregating not more than nine minutes in thirty. This interim exception in favour of hand-fired vessels should be deleted "at such time as the two Governments shall determine it would be in the best interests of Canada and the United States to do so."

*U.S.A.*

## NEW AIR POLLUTION MANUAL

The American Industrial Hygiene Association have sent us a copy of Part I of their *Air Pollution Manual*, subtitled *Evaluation*. This is a considerable volume (large 4to, 164pp. plus xx), which deals very fully with the question in a series of chapters written by a group of specialists, the names of many of whom are well known to us on this side of the Atlantic. The volume is, to us, a valuable reference book for information and data

on American conditions, practice, and research findings. It includes chapters on legislation (with details of the position in each of the States); community relations (the social aspects); measurement and analysis of pollution; effects on human health, vegetation and on animals; the economic effects; atmosphere and stack sampling; pollution from chemicals and odours; radioactivity and meteorology.

The Manual is not priced for sale, but inquiries about it could be made to the American Industrial Hygiene Association, 14125 Prevost, Detroit, Michigan.

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The U.S.A. Public Health Service has formed a Division of Air Pollution to add to its efforts in assisting states, communities and industry in air pollution problems. The division will consolidate the research, technical assistance, and training activities of PHS carried out under the air pollution engineering and medical programmes.

*Japan*

## THE SMOKE OF SAPPORO

One of the first visitors to the Society at its new offices was Professor Takeshi Saito, Doctor of Engineering, of the College of Engineering, Hokkaido University, at Sapporo, Japan. Dr. Saito is a member of the technical advisory committee for the prevention of air pollution that has been set up by the municipality of the city, and his visit to this country was in part to seek information that would assist this committee.

Sapporo is a city in the northern island of Japan, Hokkaido, which has seen a very rapid growth of population in recent years. As a result the traditional use of wood as the main fuel has given place to coal. The population now numbers 550,000, and there are 156,000 domestic stoves. Coal consumption in the winter months is 450,000 tons, of which three-quarters is burned in these domestic stoves. It is coal of an



*Sapporo in Winter. Note inversion layer and mountains in background rising above it*

unusually high volatile matter content, the ratio of volatiles to fixed carbon being approximately one. Although central heating is being installed in new buildings a great deal of hand-firing is still practised, and one of the aims of the committee is the education of the stokers. The other main objective is to develop the production of smokeless fuels. Temperature inversions are frequent during the winter months and Dr. Saito kindly let us have the adjoining photograph, which well demonstrates how much his city has in common with so many of ours.

*France*

## FORMATION OF A "CLEAN AIR COUNCIL"

On the initiative of the French Institute of Fuel and Power there has been set up in Paris a "Committee for Technical Action against Air Pollution," which is not unlike our British Clean Air Council.

Presided over by M. Louis Armand, President of the Coal Mines of Lorraine, the committee was established at a meeting on September 21st, 1960, by the Minister of Public Health and Population, M. Bernard Chenot, who is responsible to the Government for the co-ordination of air pollution activities. The function of the Committee, which comprises representatives of the fuel producers, manufacturers of plant and equipment, and the large industries, is in effect to advise the Minister on proposals for effective and reasonable measures to combat air pollution.

The Committee has established a permanent liasion with the Association for the Prevention of Air Pollution, set up in France in 1958 (see *N.S.C.A. International Conference Proceedings*, paper by Y. Queret, page 47). The work of the Committee will be on the problems relating to domestic and industrial heating and those of specific industries such as iron and steel, cement and chemicals, but will exclude the problems of pollution from road vehicles. The problems will be studied by working parties, which have already been formed, with the collaboration of specialist authorities.

## FIRST NATIONAL A. P. CONGRESS

The first national air pollution congress, organized by the Association pour la Prevention de la Pollution Atmospherique, was being held in Paris as we go to press. Some 44 papers were being presented, under the headings of (i) General Information, (ii) Industrial problems already solved, and (iii) technical problems and scientific research. We hope to be able to publish a fuller report, and abstracts of some of the papers, in our next issue.

*Italy*

## AIR POLLUTION IN MILAN

As we go to press we have received from Professor E. de Frajo Frangipane, University of Milan, summaries of reports on the investigation of air pollution in Milan during the years 1957-9. 26 reports in all are included, indicating the extent of the investigations being conducted. It has not been possible to digest the information in time for this present issue, but it is hoped to refer to the reports at greater length in the next. One item may however be mentioned: the concentration of 3:4 benzpyrene in the atmosphere of Milan ranged, in 1958, from a maximum daily average ($g./100m^3$) of 23·1 in January to a minimum of 0·29 in August. This suggests, as does other evidence, that the major problem is that due to domestic heating.

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**New Additive Eliminates Danger from Diesel Fumes Underground**

A new chemical additive, which eliminates the danger of diesel fumes underground, has recently been approved for use by the National Coal Board. Known as 'Vitasul,' it is manufactured by the Vigzol Oil Co. Ltd., Greenwich, London, S.E.10.

# Aerosol Pollutants of the Atmosphere*

*By*

*R. Lessing, C.B.E., Ph.D.*

IN the Faraday Society's General Discussion on "Disperse Systems in Gases: Dust, Smoke and Fog" at Leeds in 1936, the opening sentence of my introductory paper on the industrial aspects read:

> "Disperse systems in gases in their relation to the problems of industry and the amenities of life have not yet received the close study which their ubiquity and practical importance demand."

Whilst much research has been done since then, largely stimulated by the fog disasters in the Meuse Valley in 1930, at Donora, Pennsylvania, in 1948, by the great London fog in December, 1952, and the continuing smog nuisance of Los Angeles, many problems of air pollution still remain unsolved.

As far as fog formation and the dispersion of air masses containing natural nuclei such as salt spray from the oceans or dust from volcanic eruptions, or man-made pollutants from the combustion of fuels are concerned, much closer co-operation between meteorologist and physical chemist is needed in the future.

In this brief note I will only refer to what I consider the most pressing among the many complex problems of air pollution still awaiting intensive study by the physical chemist, that of sulphur.

Great Britain discharges into the atmosphere a sulphuric acid equivalent of about 12 million tons a year derived from the combustion of coal and oil and their products, the bulk in form of sulphur dioxide with a small proportion about 2-4 per cent. of sulphur trioxide formed—by a still unexplained mechanism—in high-temperature firing. Relatively small quantities of hydrogen sulphide are emitted in the inefficient burning of coal in domestic grates and old boiler plants. In addition an unknown quantity of sulphur compounds, perhaps hydrogen sulphide, arises from decaying vegetation.

Some of the sulphur dioxide is blown out to sea and, incidentally, is identifiable in the western part of Scandinavia, but the majority reaches the ground, being deposited in combination with particulate matter or being washed out by rain.

This vast quantity of acidic material is the main contributor to the damage caused by air pollution assessed by the Beaver Committee[1] at £250 million a year—probably an under-estimate.

Whilst the final effects of the reactions of sulphur dioxide with metals, stones, textiles, vegetation and the human and animal body are well known, it is by no means clear whether they or some of them are caused by direct reaction or through the medium of sulphuric acid. Eventually the end products of the attack by atmospheric sulphur oxides are sulphates, but the mechanisms of the oxidation of sulphur dioxide or its salts still require elucidation.

Practical experience shows that the interaction of sulphur oxides with dusts and liquid aerosols begins in the air. I venture to present a picture of the complex phenomena involved suggesting some pointers for future individual researches rather than to record achievements attained.

Much, if not most, of the dust in the air over Britain is part of the ash emitted from coal-fired furnaces. The particles vary widely in chemical composition.[2] They may be oxides or carbonates of bases, silicates,

* An Introductory Note to a "General Discussion" of the Faraday Society on the subject of "The Physical Chemistry of Aerosols," September, 1960.

occasionally fused to spheres, free silica, or carbonaceous matter ranging from tarry or oily soot to coke. They vary in shape, structure, surface, porosity and size-distribution. They will therefore differ in their capacity of adsorbing and concentrating sulphur dioxide molecules. When the particle is in collision with pre-existing $SO_3$ or $H_2SO_4$, the acid film formed tends to collect more $SO_2$. On deposition, such acid-coated particles have been found to initiate severe corrosion of metals.

Whether the oxidation of sulphur dioxide, with or without the intervention of pre-formed sulphuric acid, is promoted by catalysis and to what extent, will require the examination of different types of dust particles. These might be separated from the mixed ash dust from pulverized coal.[2]

The acid boundary layer adsorbed on particulates is affected in its reactivity, hygroscopicity and resistance to diffusion by the presence in the air of minor quantities of ammonia liberated in the carbonization stage of the inefficient burning of coal or derived from animal and vegetable sources.

The behaviour of sulphur oxides in combination with organic aerosols calls for special and urgent study in view of the increasing rate of pollution by the exhaust from motor vehicles and the emission from oil-fired furnaces. Although the sulphur content of petrol and diesel oil is relatively low, the discharged mixture of hydrocarbons and aldehydes in the former and of oily soot in the latter also contains oxides of sulphur and nitrogen which affect the stability of the aerosols formed. To what extent they are affected by collision with $SO_2$ and $SO_3$ after discharge is an open question.

The formation of acid "smuts" when burning fuel oil still remains unexplained. Their corrosive and soiling effect is particularly harmful as shown by deposits on motor cars standing in the lee of oil-fired installations.

The reactions involved in the oxidation of sulphur dioxide and leading to its final and stable form of sulphuric acid and sulphates may be promoted by catalysis as suggested. At the same time the photo-chemical effects of sunlight must also be considered. The indication that olefines under the influence of irradiation are more liable to aerosol formation[3] than other hydrocarbons suggests that sulphur dioxide adsorbed by solids may exhibit similar differences.

I submit this note, being convinced that the problem of the pollution of the air with its dire consequences can only find a practical solution when the physical chemist can satisfactorily explain the fundamental reactions involved and give a lead to the chemical engineer to devise appropriate remedial measures.

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[1] *Report of Committee on Air Pollution* (H.M. Stationery Office), Cmd. 9322, 1954.

[2] Lessing, *2nd World Power Conf. Trans.*, 1930, **4**, 174; *Fuel in Science and Practice*, 1930, **9**, 348.

[3] Renzetti and Doyle, *Int. J. Air Pollution*, 1960, **2**, 327. Prager, Stephens and Scott, *Ind. Eng. Chem.* 1960, **52**, 521.

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**Electrofilters for Nos. 7 and 8 Boilers at Blyth 'B' Power Station**

Lodge-Cottrell Limited report that a contract valued at approximately £600,000 has been obtained through Messrs. Clarke, Chapman & Co. Ltd. of Gateshead, for the electrofilters for Nos. 7 and 8 Boilers for the Central Electricity Generating Board Blyth 'B' Power Station.

The volume of flue gases to be handled by the plant will be approximately 955,000 c.f.m. at 265°F. at C.M.R. per boiler unit.

The plant will consists of three combined mechanical collectors and electrostatic precipitators per boiler unit, each precipitator being of the three stage horizontal flow high-efficiency type, provided with automatically controlled high tension transformer rectifier equipment, and the overall efficiency of the plant is guaranteed at 99·3 per cent at C.M.R. rating.

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**Lead as an Air Pollutant.**—The Warren Spring Laboratory has issued an annotated bibliography on this subject. 26 references are given. From the Intelligence Division, Library Information, Warren Spring Laboratory, Stevenage.

# *Air Pollution and its Effects on Man*

by

**P. J. Lawther, M.B., M.R.C.P.**

*The Dawes Memorial Lecture of the Association of Public Health Inspectors, presented at the Association's Annual Conference, Scarborough, September, 1960*

SIR JOHN CHARLES in his preface to the first Dawes Memorial Lecture laid down wise precepts for the proper conduct of these commemorative acts. They remain eloquent counsel to his successors in this honourable office to avoid the mere " formality of filial piety." One might add to them that it is the implicit duty of the Lecturer to display and to discourse upon the sentiments and endeavours which he and his audience share with the subject of their commemoration. That Jesse Cooper Dawes deplored pollution of the air is well known to all of us and his abhorrence of this evil was manifest in practical terms when he went to Leeds, shortly after the First World War, to inaugurate the West Riding of Yorkshire Smoke Abatement Committee. But in honouring his memory here we are united by a bond more fundamental than that which the title of this lecture would imply—as was Dawes in his lifetime, we are all engaged in the practice of preventive medicine. The superiority of this aspect of medical science to therapeutics is proverbial and this properly leads us to conclude, as Dawes did, that the problems of the effects of air pollution are best solved by its abolition. The physician, having reached and preached this radical conclusion in good company of hygienists and legislators too often returns piously to his therapy and leaves all details of prophylaxis to the technologist. This attitude is not permissible. Medical research must be directed not only to display the mechanisms by which air pollution affects man, but to produce as a result a definition of physiologically innocuous air; the physician must define air pollution in terms of toxicity before the sanitarian can proceed intelligently with his preventive measures.

The existence in industrial practice of a scale of widely accepted " Maximum Allowable Concentrations " of a great variety of noxious substances leads reasonably enough to a demand for a similar code of limits for pollutants of the common air. But industrial recommendations designed to safeguard the health of robust workmen exposed for eight hours of the day are obviously of limited relevance to a complete urban population, and the factors by which these values need to be reduced constitute the urgent problem with which medical research is confronted. Combustion of carbonaceous fuels is essential to modern economy; we tolerate with no apparent ill effect the carbon dioxide it produces; to what levels must we then reduce the ambient concentrations of its minor by-products? It must be admitted that as yet we have no firm answers to offer. Your impatience is justified, but it is with hope that the complexity of this field of research may be appreciated that the ensuing thoughts on the effects of air pollution on man are offered.

The certainty with which we are able to indict air pollution as a harmful factor in man's environment varies directly with its degree, and therefore it is reasonable to begin our study by observing the acute effects of high concentrations of urban pollution. Fortunately, in addressing this expert audience one is relieved of the obligation to discuss in detail the origins of our many pollutants, but nevertheless it is important constantly to bear in mind the fact that the description of episodes of high pollution merely in terms of average concentrations of smoke and $SO_2$ is inadequate for finer research purposes. Nor is it permissible, in the light of recent analytical work, to use the term " smog " to denote some physico-chemical entity of special significance. We are on far safer ground when we use smoke and $SO_2$ as valuable indicators of the degree of pollution of the air by combustion processes; wet fog is a common feature of the meteorological conditions which favour the accumulation of pollutants in towns, and in the present state of our physiological knowledge it may be cautiously put aside to await better evidence of its relevance to the problem. We are on safe ground when we think of " smog " as episodes in which man's domestic and industrial effluents are trapped in the air he is obliged to breathe; of these the most important and ubiquitous at the present day is coal smoke and its associated gases, much of which at lung level comes from domestic fires.

The gross manifestation of gross pollution is death. But even at this level our problem lacks specificity since death is measured in terms of excess mortality during the week in which the episode occurs. To talk of " smog victims " is to give a false impression of the ease with which individual deaths can be ascribed to air pollution. When after a serious episode of high pollution the Registrar General's figures are examined one finds that the excess mortality is among the very old and very young, and that many of the deaths are due to disease of the respiratory or cardio-vascular systems. These impressions are confirmed by clinical observations in as much as one frequently sees old patients with advanced chest or heart disease seriously distressed during periods of high pollution. But it is only when schemes are devised to select from masses of ill people those who could be called " smog victims " that one begins to realize how ill-defined is this effect even among selected groups, and the patient who is able unequivocally to attribute a severe exacerbation of his illness wholly to the onset of high pollution is rare. Yet this failure is not surprising; the ultimate progress of these diseases is sensitive, especially in winter, to many stimuli of which air pollution is but one. Despite the paucity of cases revealing the " pure " effects of high pollution it is reasonable to suspect that pollutants act mainly by virtue of their irritant nature.

**The Common Defect**

The fundamental physiological defect common to advanced respiratory and cardiovascular disease is the failure to deliver adequate amounts of oxygen to the cells of the body whose demands vary according to the activity of the tissue and of the individual; the failure may be of transport—circulatory failure, or embarrassment of airflow in the lungs, or there may be a defect in diffusion of oxygen from lung to blood or of $CO_2$ from blood to lung. If an irritant substance is breathed then an already precarious equilibrium might be disturbed in the direction of death. Alarm may increase the rate of and fatally overburden an already failing heart; the irritant may provoke bouts of prolonged coughing, a strenuous activity which may be intolerable to the patient; it may produce reflex contraction of the rings of muscle which surround the bronchial tubes and by an asthma-like process produce a fatal increase in airway resistance; or it may provoke such a secretion of fluid that diffusion across the cellular barrier between blood and lung becomes utterly

inadequate. In the lungs of a patient whose hold on life is precarious there is indeed scope for intense air pollution.

With such clear-cut and highly probable hypotheses in front of us there would seem to be but few steps to the identification of the noxious substances. One ought to be able to simulate in the laboratory simplified versions of urban atmospheres which when inhaled by healthy subjects produce in miniature replicas of the states already mentioned, and indeed we are able to produce measurable changes in lung function by compounds which are present as impurities in urban air, but only by using concentrations greatly in excess of those which we observe in the air. Many explanations of this failure come to mind: suspected pollutants may in fact be innocuous and the villain is yet to be discovered and tried, or having used the right one it has been exhibited in the wrong physical form; combinations of various pollutants, innocent by themselves may combine to sinister effect; healthy persons may be completely valueless as experimental subjects, or the experimental exposures may be too short. Certainly in all biological experimentation there is a tendency to underestimate the resilience of the human subject who by his very nature adapts rapidly to changes in his environment. So the patient with bronchitis, troubled as he is by a hypersecretion of mucus in his respiratory tract, may by this very pathological feature of his disease protect himself against further irritation. Again, we tend to forget the astounding variability in response to noxious stimuli displayed by individual human beings.

These observations naturally lead one to consider the many merits of animal experiments in which variables may be more easily controlled, but despite much careful work all over the world few results have yet emerged which are directly applicable to the human problem. It is again possible that the healthy animal is the wrong subject for these experiments and there seems to be promise of better results if attempts to produce chronic bronchitis in small animals are successful.

While contriving to identify by experiment specially noxious constituents of these acute episodes the answer may well be found by correlating the clinical observations of large numbers of patients with the chemical and physical analysis of the air they breathe. This method and others using specific indices of morbidity such as sickness absence rates are being used continuously but they too have severe handicaps; acute air pollution is only one of many noxious stimuli which may be deleterious to respiratory cripples, and even when individual uneven response is minimized by the observations of large numbers one must concede that the reaction of the mass is critically dependant also upon the coincidence or precedence of epidemics of respiratory infection. Indeed, the apparent difference in toxicity between " smogs " may merely reflect the different numbers of patients left by preceding epidemics susceptible to the severe effects of pollution.

But to discourse on difficulties and fallacies is not to abandon hope of solution. Rigorous self-criticism of continuing endeavour will ensure the emergence of answers of greater validity, and until the certain identification of noxious constituents good working rules may be made from observations of the relationship between morbidity and mortality and the concentrations of commonly accepted indicators of pollution. It may thus be possible to calculate limits for emissions which will reduce significantly the likelihood of disaster in stable weather conditions with accompanying temperature inversions.

No similar ray of hope is visible when we turn our attention to the chronic effects of pollution which are so often regrettably overshadowed by the drama of " smog." Two terrible diseases of the respiratory system, chronic bronchitis and lung cancer, are much commoner in towns than in the country and it is eminently

reasonable to suspect that air pollution is concerned in their development.

**Bronchitis**

Chronic bronchitis is a disease which in Britain kills 30,000 people each year and causes the loss of 20 million working days. The misery it causes is beyond measure. Yet ironically, there exists no complete definition of the disease which satisfies all clinicians or the purposes of all research. It evolves over many years through many stages, and is often only confidently recognized in retrospect in the light of its crippling or fatal sequelae. For research purposes in this field it is more precise to consider symptom complexes, rather than diagnoses, in relation to possible causes, but it may be said in general terms that the fully fledged disease is characterized by cough, breathlessness, and the production of sputum. Winter exacerbations of these symptoms are common when the sputum becomes infected. Many theories have been advanced to explain in pathological terms the evolution of this disease; some think that the first functional change is the hypersecretion of mucus by certain cells present in the lining of the bronchial tree. Hypertrophy and proliferation of these cells is followed by yet further secretion and the mucus ultimately becomes infected with bacteria. Over the years bronchial and pulmonary tissue is destroyed by these infective processes and emphysema results. This hypothesis seems attractive for our purposes in that it requires a stimulus to mucus secretion which might well be provided by irritant air pollutants. Attempts to produce this cycle of changes are being made in experiments on small animals. Air pollutants have been shown to cause a decrease in ciliary activity in bronchial mucosa and this finding may be of relevance to our problem; the normal bronchial tree is continually swept clean by the beating towards the exterior of long whip-like processes called cilia: inhaled particles impinge on the mucus which coats the respiratory tract and are gradually ejected by this mechanism which can, however, be inhibited by inhaled irritants and is greatly reduced or abolished in fully developed bronchitis. These important phenomena are being investigated by experimental methods but most of our information on the causes of bronchitis comes from the application of epidemiological techniques. In using such methods the epidemiologist admits that the contrived lifelong experiment is impracticable, and strives therefore to observe numerous people, undisturbed, in their suspect environment. Their health is compared with that of members of populations resembling them as closely as possible in all respects other than in their exposure to pollution. The properly designed epidemiological investigation is a natural experiment on a vast scale.

Air pollution is only one of several unpleasant features of urban life which merit consideration as causes of the excess bronchitis found in towns; industry, overcrowding, poor diet, frequent infections, all may play a part. But recent researches on standardized populations incriminate air pollution as one of the most serious factors in the aetiology of this dread disease. Cigarette smoking appears to be of roughly equal importance. Epidemiological research is complex and sometimes many years must elapse before large experiments begin to yield valid results.

We have before us in the implementation of the Clean Air Act a magnificent opportunity to plan large natural experiments to display the effect on health of removing smoke from the air of our cities. This opportunity must not be lost.

**Cancer of the Lung**

Fifty years ago cancer of the lung was a rare disease. Last year it killed about 20,000 people. Next year it will kill even more. The rate at which the incidence of the disease has been increasing is frightening. There are two good reasons for suspecting that air pollution plays a part in this appalling story—lung cancer is commoner in towns than in rural areas,

and town smoke contains many substances which can cause cancer in experimental animals. The incidence of lung cancer in Britain follows closely the size of the community, which in turn largely determines the smoke content of the air. As when we seek the cause of chronic bronchitis, great caution must be used before concluding that air pollution alone among the many hazards of urban life is responsible for the disease. We must constantly bear in mind that we are looking at an alarming increase in the incidence of lung cancer, and taking note of the long exposures needed to provoke cells to malignant change we must conclude that a new carcinogenic factor began to act on the population at the turn of the century. Though coal smoke by virtue of its richness in carcinogenic hydrocarbons remains suspect as a cause of the disease, it cannot be said by itself to fill the role of the postulated new factor; on the contrary there is good reason to believe that urban air contains less smoke than it did in the last century. Some workers would claim that industry has produced new substances which could be responsible for the rise. There are indeed at least five specific industrial causes of lung cancer which happily are now recognized, but it is not reasonable to suppose that any of these or an as yet unidentified industrial hazard could be responsible for the overall changes we see.

The exhaust products of petrol and diesel vehicles because they contain small amounts of carcinogenic substances have repeatedly been accused of causing lung cancer. Fortunately there is no evidence to support this view; people who by their occupation are exposed to high concentrations of traffic fumes show no excess of lung cancer in their ranks, and neither form of engine has been polluting the air long enough to be responsible for the observed rise in mortality.

As more and more evidence comes in from workers all over the world it becomes increasingly clear that the smoking of tobacco, especially in the form of cigarettes, is linked so closely to the incidence of lung cancer that to ignore the likelihood of the relationship being causal would be gross folly. We must consider ourselves indeed fortunate that this dangerous, highly personal, form of air pollution may so easily be abolished.

**Town and Country**

We are of course left with the need to explain the difference between the incidence of lung cancer in town and country. This excess mortality is seen at all levels of smoking in the most densely populated areas of the country, but workers differ in their assessment of the risk which non-smokers incur by living in smoky towns. Some believe that the present difference between the mortality in town and country is a reflection of the spread in years past of the habit of cigarette smoking from the cities to rural areas. On the present evidence it seems probable that in Britain air pollution is responsible for a small proportion of the lung cancer in our midst. In this connection we may seek further comfort from the fact that the Clean Air Act, while perforce leaving some pollutants unhappily unchecked, will, by its reduction of smoke, reduce the carcinogenic content of the air.

The examination of specific industrial atmospheres in relation to the health of workers is of great value to the study of community air pollution, for in this field it is possible to plan large-scale epidemiological investigations. Experimental short-term exposures of individuals in the laboratory are obviously less valuable than the observations of the clinical state of hundreds of workers who may be inhaling a specific pollutant during the whole of their working lives. It is of interest to note in this respect that several past surveys of the health of workers exposed to high concentrations of sulphur dioxide, a pollutant regarded with great suspicion in the communal air, have shown no specific signs of ill-health. Mention has already been made of similar comforting findings among those who work amid

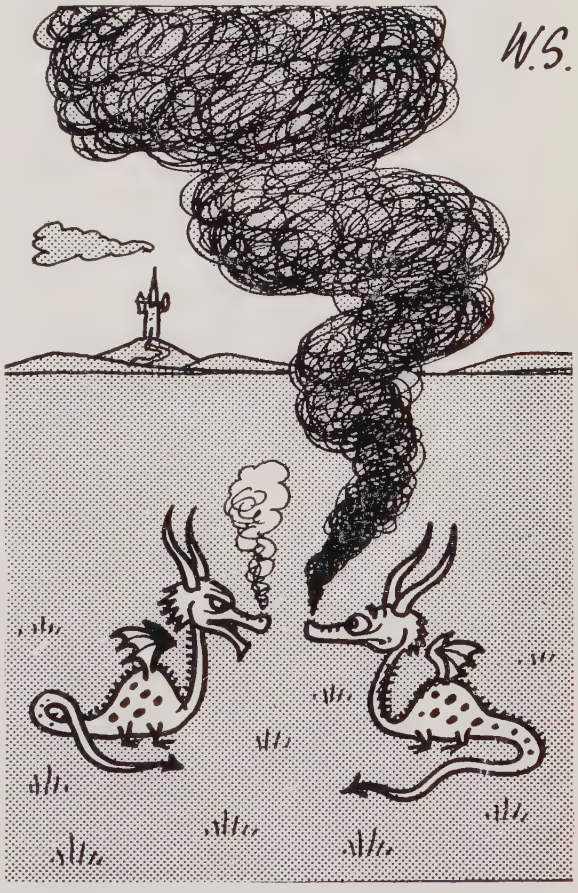
much traffic fumes. There is some recent evidence that process workers handling some common irritant chemicals in the by-product plant in a foundry have a higher incidence of chronic bronchitis than their fellows employed elsewhere in the works. These findings repay careful study and may well indicate the need to repeat, using the improved epidemiological techniques now available, some of the old surveys of workers exposed to sulphur dioxide.

The first pure carcinogen was discovered as the result of the observations of cancer in industry, and the first specific risk of cancer of the lung was seen to occur among the cobalt miners in Saxony. Since it is impossible, and unthinkable, to submit men to lifelong experimental exposure to substances suspected of being carcinogenic it is doubly important to watch very carefully for the occurrence of excess disease among workers in any industry. The study of these occupational factors may prove to be one of the most fruitful fields in cancer research and lead us through the practice of hygiene to a fuller knowledge of the mechanisms involved in neoplastic change.

**Simple Filth**

Our concern with specific mortal illness must not lead us to neglect the condemnation of air pollution for its simple filth. We have lived with it so long that we accept as a normal part of urban life the shameful soiling of clothes and furnishings, the obscuration of sunlight, the stunting of vegetation, the rotting of buildings. Who can begin to assess the mental and physical illness caused by the struggle to cope with this despoliation and decay?

A memorial lecture is no proper vehicle for a complete academic review of a subject, and on this occasion you have been given but a rough outline of the problems which confront the physician who looks with the same anger which moved Dawes at the havoc caused by our sordid folly. The magnitude and complexity of these problems are frequently underestimated and the resultant confusion of thought too often weakens the advocacy of those who strive to abolish all forms of air pollution. In the light of present knowledge, and in the dimness of our ignorance, the concept of a " Maximum Allowable Concentration " for any pollutant of the ambient air is inappropriate when our aim should be the utter condemnation of this social evil. To one engaged in the slow search to display the mechanism of its effects, there is great comfort in the knowledge that you, who were Dawes' colleagues and are his successors in the custody of the public health, stand zealous guards against the fouling of our air.




**"Why don't you go and eat coke?"**
(The interest of the *News Chronicle* in clean air, exemplified by the successful joint poster competition with the Society and the projected photographic competition (see page 93), is shown also by this Will Spencer cartoon, published shortly before the closure of the paper. The original, framed, has been kindly presented to the Society.)

# SMOKE CONTROL AREAS

## Progress Report

### POSITION TO SEPTEMBER 30th, 1960—TOTALS

| | England and Wales | Scotland |
|---|---|---|
| **Smokeless Zones** (Local Acts) in Operation .. | 44 | 1 |
| Acres, 3,400 | | |
| Premises, 41,060 | | |
| **Smoke Control Areas in Operation** .. .. | 194 | 4 |
| Acres, 25,610 | | |
| Premises, 150,730 | | |
| **Smoke Control Orders**— | | |
| Confirmed .. .. .. .. .. | 135 | 8 |
| Submitted .. .. .. .. .. | 123 | 4 |
| Proposals Notified .. .. .. .. | 271 | 15 |
| **Grand Totals** .. .. .. .. | 767 | 32 |

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Autumn, 1960), which gave the position up to June 30th, 1960. They now show the changes and additions to September 30th, 1960.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

### ENGLAND AND WALES

**New Smoke Control Areas in Operation**

Aireborough U.D. No. 2a, Barnet U.D. No. 1, Barnsley C.B. No. 1, *Bebington B. No. 1, Bermondsey M.B. No. 2, Bolton C.B. Nos. 4 and 5, Bury C.B. No. 1, Crompton U.D. No. 1, Dewsbury C.B. No. 1, Ealing B. No. 1, Elstree R.D. No. 1, Friern Barnet U.D. No. 1, Hayes and Harlington U.D. Nos. 11, 12 and 14, Hebburn U.D. No. 1, *Hendon B. No. 1, Hornsey B. Nos. 1 and 2, Islington B. Nos. 1 and 2, Knottingley U.D. Nos. 2 and 3, Leamington Spa B. Nos. 1 and 2, Leicester C.B. No. 3, Lewisham M.B. Nos. 3 and 5, Nuneaton B. No. 1 (Part), Pontefract B. No. 1, *Rochdale C.B. Nos. 1 and 2, *Rotherham C.B. Nos. 2 and 5, *Sedgley U.D. No. 1, *Shipley U.D. No. 1, S.E. Derbyshire R.D. No. 3, Southgate B. No. 1, *Wallasey C.B. No. 2, Wandsworth M.B. No. 2, Warrington C.B. No. 1, Wortley R.D. No. 3.

**New Orders Confirmed but not yet in Operation**

Aireborough U.D. No. 7, Birmingham C.B. Nos. 4 and 5, *Bolton C.B. No. 3, Brentwood U.D. No. 2, Brierley Hill U.D. Nos. 8, 9 and 10, Bristol C.B. Nos. 2 and 5, *Chesterfield B. No. 1, Crawley U.D. No. 2, Croydon C.B. No. 2, Dagenham B. No. 2, *Denton U.D. Nos. 3 and 4, Ealing B. No. 3, *Halifax C.B. No. 2, Hayes and Harlington U.D. No. 18, *Heston and Isleworth B. No. 2, *Kensington M.B. No. 2, Leeds C.B. No. 2, Leyton B. No.1, *Rotherham C.B. Nos. 4, 6 and 7, *Sale B. No. 1, *Smethwick C.B. No. 2, *Spenborough B. No. 1, Tottenham B. No. 2, Wallasey C.B. Nos. 4 and 5, Walthamstow B. No. 1, *Wanstead and Woodford B. No. 1, *Warrington C.B. No. 2, West Ham C.B. No. 1, *Wortley R.D. No. 2.

**New Orders Submitted for Confirmation but not yet Confirmed**

Aldridge U.D. Nos. 2 to 5, Barnes B.

No. 1, Barnsley C.B. No. 2, Billingham U.D. No. 1, Blackburn C.B. No. 1, Bootle C.B. No. 3, Bradford C.B. No. 2, Brierley Hill U.D. No. 11, Brighouse B. No. 2, †Bristol C.B. No. 6, Carshalton U.D. No. 1, Dagenham B. No. 2, Dartford B. No. 1, Deptford M.B. No. 2, Ealing B. No. 4, Edmonton B. No. 3, Enfield B. No. 2, Finchley B. Nos. 1 to 4, Halifax C.B. No. 3, Harrow B. No. 1, Kensington M.B. No. 4, Kingston-upon-Hull C.B. Nos. 4 to 8, Leeds C.B. Nos. 4 and 5, Leicester C.B. Nos. 4 and 5, Lewisham M.B. Nos. 6 and 7, Liverpool C.B. Nos. 10 and 11, Manchester C.B. Nos. 2, Newcastle-under-Lyme B. No. 1, Oldham C.B. No. 1, Reading C.B. Nos. 3, 4 and 5, St. Marylebone M.B. No. 4, Sedgley U.D. No. 2, Sheffield C.B. Nos. 2 and 5, Shrewsbury B. No. 1, Smethwick C.B. No. 3, Stoke Newington M.B. No. 5, Walsall C.B. Nos. 1, 2 and 3, Wetherby R.D. No. 1, Willenhall U.D. Nos. 7, 8 and 9, Woolwich M.B. Nos. 7 and 8, Wortley R.D. No. 4.

† This area was previously designated No. 7.

**Proposals Notified to the Minister**

Brentford and Chiswick B. No. 2, Carlton U.D. No. 1, Denton U.D. No. 5, Ealing B. No. 5, Eccles B. Nos. 1b and 2, Ellesmere Port B. No. 4, Finchley B. Nos. 5, 6 and 7, Goole B. No. 1, Halifax C.B. Nos. 4 and 5, Heckmondwike U.D. No. 2, Heywood B. No. 2, Holborn M.B. No. 4, Hornchurch U.D. No. 3, Islington M.B. No. 3, Kensington M.B. No. 5, Leamington Spa B. Nos. 9 and 10, Leicester C.B. Nos. 6 and 7, Lewisham M.B. Nos. 8 and 9, Manchester C.B. No. 3, Newburn U.D. No. 2, Oldham C.B. No. 3, Paddington M.B. No. 3, St. Helens (Lancs.) C.B. Nos. 1 and 2, St. Pancras M.B. No. 3, Sale B. No. 3, Slough B. Nos. 2 and 3, Solihull B. Nos. 2 and 3, Stretford B. No. 2, Sunderland R.D. No. 1, Urmston U.D. No. 2, Wakefield C.B. No. 2, Walthamstow B. No. 2, Westminster M.B. Nos. 6 to 9, Willenhall U.D. No. 10, Willesden B. No. 3, Woolwich M.B. Nos. 9 to 12, Yiewsley and West Drayton U.D. No. 3.

## SCOTLAND

**New Smoke Control Areas in Operation**

Coatbridge No. 1.

**New Orders Confirmed but not yet in Operation**

Dumbarton No. 2, Dundee No. 2, Edinburgh (City 1).

**New Orders Submitted for Confirmation but not yet Confirmed**

Edinburgh (City 2), Glasgow No. 5, Kilmarnock No. 1, Lanark County No. 1.

**Proposals Notified to the Minister**

Dundee Nos. 3, 4 and 5, Edinburgh (Sighthill 4), Glasgow No. 6, Motherwell and Wishaw No. 1.

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# APPEAL AGAINST CLEAN AIR ACT

On the 6th October the first case in Warrington under the Clean Air Act was heard at the Borough Court. A firm of builders, Berry and Gray, appealed against the decision of Warrington Corporation ordering them to carry out adaptations to fireplaces in houses owned by them.

The appeal was on the grounds that it would have been fairer for the notices requiring the work to be done to have been served on the occupiers of the property concerned. It was claimed that the tenants would receive a greater benefit from the adaptations. Mr. William Hunt, a Senior District Health Inspector employed by the Corporation, said that the houses were in the area of the Council's first Smoke Control Order, which affected 648 dwellings. 80 per cent of the adaptations in this area had been carried out by landlords, and the Corporation had found it necessary to serve notices on only about 20 people. He agreed that it was not stipulated in the memorandum from the Ministry as to who should receive the notices if adaptations were not carried out.

Mr. David Binns, Deputy Town Clerk of Warrington, said that in a number of cases where it had been impossible to reach an agreement with either the tenants or the landlord over the carrying out of adaptations the Council had taken the view that the owner of the property should do the work.

Turning down the appeal, Mr. W. A. Boulting, Chairman, said the Bench had taken into consideration the degree of benefit to the people concerned and were ordering that the work should be done by the owners within 28 days.

# FUEL EFFICIENCY

The Sixth Progress Survey of the National Industrial Fuel Efficiency Service is another record of excellent work done. Sir Leslie Hollinghurst, the Chairman, in a statement opening the report, states that fuel efficiency has been increased more rapidly than the Pilkington Committee expected when it made the report that included a recommendation to establish NIFES.

" NIFES engineers," writes Sir Leslie, " have been able to make a great contribution to this advance, largely because they have boldly tackled the major difficulty; i.e., the Committee's doubts whether the benefits of fuel efficiency would be attractive to the individual industrialist unless he was offered special inducements to take action. They have been successful because they have presented the case for fuel efficiency on its financial advantages. They have in fact shown that savings, averaging 20 per cent of fuel consumption can readily be made . . ."

The year 1959–60 has been difficult but successful, says the report. There was a reduction in engineering staff, largely due to the N.C.B's enlargement of its technical services, but work was well maintained and revenue was increased.

Under the heading " New Fields for Investigation " reference is made to the need for reduction of grit and dust emission as a result of the Clean Air Act. Apparatus designed by BCURA is now being used by NIFES engineers as a basis for advice on grit and dust emission problems. The apparatus is also being used to test the efficiency of grit arrestors and their operation, since the Act requires that they must be properly maintained and used at all times.

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**Victor Products (Wallsend) Limited Gas-Fired Incinerator**

Victor Products (Wallsend) Limited announce a compact 1·6 cu. ft. capacity gas-fired incinerator in which combustible waste material either wet or dry, is completely reduced to ash.

The Victor Incinerator, which costs 69 guineas, will be marketed by the Northern and North Eastern Gas Boards, and will be available initially only in the areas covered by these Boards.

Operation is entirely automatic and, as there are no moving or electrical components to wear out, maintenance is virtually nil.

A $\frac{1}{2}$-in. gas supply can be connected from either side or underneath.

Operation is completed in two actions: (1) A foot pedal is depressed which raises the lid to take the waste material, leaving both hands free. (2) A dial is set for the burning period required when the main gas burner is automatically lit.

Combustion is rapid and constantly controlled by a sensitive self-regulating draught stabilizer while smoke and fumes are drawn by air turbulence into a second chamber. In this " smoke chamber," lined with firebrick and operating at 800°C. the products of combustion are superheated and rendered smokeless and odourless.

Cool air, introduced via the draught stabilizer, mixes with any gaseous left-over products and disperses all remaining fumes. The result is a completely smokeless and odourless process which leaves only a small quantity of ash to be periodically removed from a drawer at the front of the incinerator.

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On the 9th November, 1960, the British Transport Commission, British Railways, were summoned for emitting dark smoke from the chimney of a steam locomotive at the Patricroft Motive Power Depot, Eccles, on the 5th August, 1960. In this case dark smoke was emitted for 17 minutes and a fine of £5 was imposed.

In a second case involving another locomotive engine on the same date, the Commission were summoned under Section 19(2) for not using practicable means for minimizing the emission of smoke from the chimney of the engine, i.e. not using the steam injector or " blower " to minimize the smoke. In this case a fine of £5 was imposed.

# *The President's Address to the Harrogate Conference*

MY very first task—and I hope in this I shall have the tolerance of the Parliamentary Secretary—is to express to the members of the Society my apology and my regret that I failed so completely to attend and do my duty at last year's meeting. I should have been sorry in any case, but particularly last year because of the great occasion and because of the international nature of the gathering. Illness was my excuse but not my consolation. All that I can now say is that as one looks back over the past twelve months and as one has more time to re-read the published papers, it is seen to have been an unquestioned success—and to have contributed in many ways to the study of this long and difficult problem.

And now I turn to the much more pleasant business of thanking you, Mr. Parliamentary Secretary, for your presence and your address. If I may allow a personal note to creep in for a moment I would say that this is a particular pleasure to me because of the very happy memories I still treasure of the time in the last war when your father and I were working closely together—days so long ago that you were then not much more than an unrecognized star just above the horizon. That you have attended our Conference this year marks once again, if that were necessary, the close interest which your Ministry takes and has taken in our Society and in the work for which our Society has so long stood; and we are very grateful.

We are, too, greatly indebted to you for the admirable survey which you have made. The Committee of which I was Chairman set considerable store—as it indicated in its report—on there being established a Clean Air Council, independent of the inhibitions—as we suspected or feared—of official caution and independent of the interferences of political pressure. I well remember too how your Minister's predecessor said quite frankly that he was not going to have an irresponsible pressure group clamped on his back. It only shows that there are two points of view to everything! But I am bound to say that having now for some years seen the Clean Air Council in operation under the wise and clear chairmanship of your Minister, I do not think that there is much more that an independent council such as we envisaged would have in fact secured; and quite possibly it might have done less. We did not anticipate a vigorous and positive policy in an officially and ministerially controlled body; for that view we have I think the justification of past experience. But we were wrong. The members of my committee fully realized that the main operation would be education and persuasion; and that in our form of life and government it was not, and could not be, a matter of compulsion. Within these inevitable restrictions the Clean Air Council has unquestionably been both active and constructive.

Progress it is true has not been as rapid as we had hoped, and, as your Minister has made clear, not as rapid as he had hoped; but progress *is* being made. Some local authorities might on their own have planned to make greater speed; and some might certainly have wished to have a freer hand. But I do not know that progress has in fact been prevented by over-cautiousness or dilatoriness on the part of Government; whereas certainly in some directions there might have been even less progress if the central Government had not retained the ultimate responsibility in its own hand.

It is customary at this stage in our annual conferences for the President to deliver himself of his long cogitated views and his suggestions on various aspects of our problem; and very valuable have been many of the presidential addresses. But I am in a difficulty. I have long since, I think, said everything that I have to say, at least that I have thought worth saying. It is not possible to have been so deeply involved as I have been in these recent years, without having poured into both discussion and action everything that I could. You will therefore forgive me if I do not attempt anything of the nature of a pontifical utterance. But there are some points that I feel need to be made.

In the first place I would like to say a word on the vexed question of solid fuel. It is unfortunate—if probably largely inevitable—that we have never so far as I know had any clear direction or guidance from the Government as to the controlling principles and the desirable pattern of fuel user for the country. Almost the first thing that I asked for when I took on the chairmanship of the Air Pollution Committee was to be given some statement of the Government's policy in respect of fuel and fuel user. It was explained to my committee that it was in fact impossible to lay down a long term policy as between coal and gas and electricity and oil and atomic power; and certainly if one considers the extraordinary changes and wide variations which we have experienced in these post-war years, one would, to be fair, have to sympathize with anyone charged with the production of a national fuel policy. I do question whether there might not have been more guidance. Just think of those years; the coal famine of the years immediately after the war; the poor qualities of coal so often then supplied—nutty slack for instance; the endless electricity cuts; the inability to export any of our coal—to Ernest Bevin's continual lamentations;—the vastly increasing demands for petrol and diesel oil; the growth of supplementary chemical industries entirely dependent on the working of imported oil; the challenge and rosy promises of atomic power, now no longer so promising—at any rate in the nearer future; finally the shattering near collapse of the coal trade. Much of this was inescapable, but was it all necessary? One must indeed sympathize with the coal merchants who in this single decade have seen such a complete reversal of conditions from an out-and-out sellers' market to their present most difficult and in some ways almost precarious position in an uncertain consumers' market.

But in spite of all these uncertainties, there has in fact been no change in the basic problem as to the means of securing clean air so far as the main fuel is concerned. The problem that faced the Government in regard to any national fuel policy, also faced my committee in its search for a clear and workable formula for clean air. My committee for itself concluded that the great bulk of the fuel to be used in a clean Britain would still be solid fuel in solid fuel-using appliances. That I believe to be absolutely the position still. In the present state of knowledge and development, that must mean for the vast majority of individual users one or other of the types of smokeless fuel including of course low volatile coal; but coke—the right type of coke—is still and must be the major weapon. I would like here to pay tribute to the work of the British Standards Institution on the Standard published last year for Coke for Domestic *Open* Fires. This carries us a considerable step forward in the solution of the most difficult part of the problem of providing a perfect coke. There have too been great advances in the proved practicability of the production of good reactive coke from coals hitherto considered to be non-coking; and there have been most encouraging results from the N.C.B.s, and other, experiments in the production of various forms of smokeless fuel; as well as of clean coal, where my predecessor Dr. Lessing blazed the trail 40 years ago. All this is excellent, though it is taking rather a long time.

There may well in due course be

developed domestic heating appliances which can safely use many of our raw coals without nuisance and without skilled, or at least without skilful, and continuous attention. But these have not yet been developed. So if we believe in clean air, if we believe that too long have we subjected ourselves and our children and our aged to the unquestioned and lethal dangers of foul air, we must accept that there must in due course be some control over all domestic firing appliances wherever people are thickly congregated; or over the fuel used—or both. In industry it is as we know perfectly possible to use in nearly all boilers and furnaces the poorest of coals so as reasonably to fall within the Act. This is not so and probably never can be the case with the domestic hearth. I would not like to leave this here without paying tribute to the work of many people in helping to solve the domestic problems —the Director and Staff of B.C.U.R.A. and Sir John Charrington among them; and perhaps above all the several women's organizations, which play such a vital part and have done such valuable and public-spirited work. The results can only be achieved by the united efforts of all concerned. In this connection it is of interest I think to note that in the U.S.A. the bituminous coal industry has established a full time staff of experts headed by Harry C. Dollman, well known in the air pollution world in the States, as its director. " Industry," he has said, " is aggressively moving forward to solve air pollution control problems and the Air Pollution Department of the National Coal Association has been created to aid this movement."

This naturally leads one to a word on what has already been achieved in industry here generally. It is pretty remarkable. There are many processes which have yet eluded cure—largely because of the cost. In a country so small and so heavily populated as ours, which has to maintain itself against overseas competition that is increasing yearly with terrifying speed —with the new vast industrial developments in so many other countries, with new competitors joining our old competitors—it would be completely unrealistic to place such a burden on our own industry as would be involved in the immediate compulsory modernization of all plant and equipment that uses fuel. But no one can go through the country without seeing for himself what an immense improvement has been achieved in regard to large furnaces and steam-raising plant. Where they are available the results of systematic air sampling in many places bear this out to a marked extent.

It would be impossible here to attempt to give even a summary of all the work that has already been done in the industrial sector. I would commend to you the Chief Alkali Inspector's Report which does, too, underline the immense difficulties, technical and financial, that are involved in many of the long-standing processes of our country. But there are a few points I would like to make—a few salient points.

The heavy chemical industry has expanded about threefold since the last war. New industries, *e.g.* man-made fibres, bromine from seawater, carbon-black petrochemicals, have developed; and all these plants have been fitted with fume, dust, etc., treatment plant to the satisfaction of the Alkali Inspectorate.

Oil refining has in this same period increased from 2·5 to 40 million tons per annum; and the comparative freedom from major complaint shows the efficacy of the means taken. The whole of the expansion has been by plant to the satisfaction of the Alkali Inspectorate.

Cement production has doubled. All new production and much of the old has been fitted with dust arrestment plant. The dust problem on Thames-side remains a serious problem; the only cure, precipitators and high chimneys, has to be measured, in cost, in terms of millions of pounds.

All the new power stations are virtually smokeless, with very high performance grit arrestment plant and the latest with high chimneys (up to over 500 ft.). Older units with

their low chimneys and sub-standard grit arrestment plants are still the cause of trouble and complaint, but they are steadily on the way out. No grit arrestment and no sulphur treatment plant has yet been proved to be hundred per cent successful. An efficiency of grit and dust arrestment of 97 per cent+ still leaves a serious if much localized problem; but the advance has been immense.

The iron and steel industry is embarked on a very costly campaign to deal with emissions from ore driers, sinter plants, blast furnaces and the new techniques of steel production. At the new steel works at Newport the capital cost of gas and fine dust prevention in all directions will run into millions. The gas industry is steadily getting rid of horizontal retorts.

The coking industry has a working party with the Alkali Inspectorate to investigate the whole matter of " green gas " from the charging of ovens. The latest ovens completing or planned (S. Durham Steel at Greatham and Richard Thomas & Baldwins at Newport) are fitted with double collecting mains. The ceramic industry is now seriously concerned. Mechanical stokers are steadily replacing hand firing. The bottle oven of the Potteries is rapidly giving way to smokeless techniques such as tunnel kilns. There are working parties with the Alkali Inspectorate to examine the specially difficult problems of salt glazed ware and blue engineering bricks.

Each industry brought under the Alkali Act by the Order of 1958 has its organization to discuss its problems with the Chief Alkali Inspector so as to arrive at a national policy; and all new plants erected must be fitted with " best practicable means " to deal with their emissions. But there are still problems where as yet we can see no answer. To these last Mr. Nonhebel's paper has been a real contribution. Where no solutions appear likely in the near future, tall chimneys have been required to aid dispersal and reduce ground level concentrations; that is the best that can be done with present knowledge.

As can easily be seen from this brief summary, during the past few years industry has done much and has already spent or allocated millions of pounds to clean air measures.

Many industrial processes did in fact from the outset come under the control of the Act; but I know that some local authorities feel that too few have come under their control. The Minister's recent decisions in regard to Manchester, Sheffield, and Liverpool show how the wind is blowing, and that where the answers are really known and where a local authority really has adequate technical and experienced staff, the long-term policy of Government is to bring industrial processes increasingly within the direct control of the Act.

I would like to turn for a few minutes to the question of research, and with that and in that I include every stage of research not only the fundamental work, the establishment of the basic facts and truths, but also all the means of their application, as well as the dissemination of the information in appropriate terms to all the people who are or ought to be concerned, the design of the best equipment whether for using fuel or measuring air effluent; and I would add the education of all and sundry as to the facts, the dangers, the methods, the benefits. Anyone who attended the Society's Jubilee Conference last year must have been struck by the almost world-wide interest that was shown; the Society has every justification for including now in its quarterly publication, *Smokeless Air*, an International Section with Honorary Correspondents already acting for South Africa, Norway, West Germany, Italy, the U.S.A., Ireland, France, Belgium, the Netherlands and Poland. That there should be this widespread and growing interest is excellent; but it does mean that there must also be means of pooling—as far as that is practicable—the knowledge that is being so busily collected all over the world. It is unfortunately almost impossible to find any sure means of completely securing this pooling of

knowledge; and so inevitably there is a great deal of duplication of effort. If this problem has proved intractable even within one single country, how much more difficult now that so large a part of the world is actively interesting itself. That there is immense effort being put into this whole question is undoubted. The Clean Air Council had a little while ago a quite imposing statement laid before it, of the research work at present being officially carried out or sponsored in this country; and recently I was looking at a statement of the official work being done in the U.S.A. which had been published by the U.S. Public Health Services, covering the year 1959. There were something between 80 and 90 major research projects being carried out by Federal bodies and over 70 other research projects in non-Federal institutions covered by Federal grants. I was, also, favoured with the syllabus for the Third Air Pollution Research Seminar which was held at New Orleans in March of this year—in which papers were presented for discussion from nearly half the States in the Union as well as from Canada, U.S.S.R., Mexico and Great Britain. I mention these points to give you some idea of the immense interest in, and the immense expenditure on, research all over the world but particularly in the U.S.A. This too is borne out by the bulky Digest of State Air Pollution Laws that has been recently produced by the U.S. Department of Health Education and Welfare. When you remember that every one of the 50 States has its own laws on this subject, and that every municipality is largely its own master in this problem of clean air, then we may indeed be thankful that here in this country we are in this respect so much better off—even if we do not yet feel that everything is as it should be.

All this shows you too what an amount of knowledge and experience, of trial and error, of half-truths, and likely and unlikely causes and cures, there are, through which those responsible have to thread their difficult path. I do not think that there is anything more that the N.S.C.A. with its slender resources can do, to filter as it were and digest all this material for the better guidance and assistance of those concerned; but it does seem that the Ministry or perhaps the D.S.I.R. at Warren Springs might consider this matter further. It is a real problem.

Before leaving the activities in other countries I too must refer to what I think is one of the most exciting pieces of news from the air pollution front, namely the passing by the California State Legislative of the first act directed at motor exhausts. I do not mean smoke or visible exhaust. A Motor Vehicle Pollution Control Board has been established to administer the new powers, and in particular " to determine and publish the criteria for approval of motor vehicle pollution control devices " and to approve and issue certificates of approval for such devices. As soon as there are *two* approved devices, then from one year after that date no new motor vehicle will be registered in the State of California unless it has an approved device; and this rule will apply within the following two years thereafter to every motor, private or commercial, that changes hands. That this should happen first in Los Angeles is not surprising, because as Smith Griswold, its very effective Air Pollution Control Officer, states in his latest review of his department's activities, it is now completely established that the operation of gasoline-powered vehicles accounts for the lion's share of the notorious Los Angeles smog. There is no other part of the world I believe where quite the same compelling causes operate, but there is no doubt that every populous country must give increasing and urgent thought to the problem of automobile exhausts—as well as to the general question of gases in the air; and it is well that publicity should be given here in this country to such developments and actions elsewhere, because we also will have to face this sort of action—remembering too that our fuels, liquid and solid, have a far higher sulphur content, and to that extent are probably more dangerous,

generally, than most of the fuels of the U.S.A.

I quote this as just one example of the many developments and wide ranging activities that have been occurring since my committee reported. The future will see many more, and it is essential that we keep abreast with all this information so that the latest improvements and inventions should at least be incorporated into any new designing or planning. That is why I have stressed this question of publicity; and that I feel must always be the keynote and a main objective of each annual conference of the National Society for Clean Air.

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# Q. & A. on Coal

The National Coal Board have prepared and published a valuable little pamphlet of 24 pages entitled " 50 Questions and Answers on British Coal." The questions are to the point and the answers are full and informative. They cover the whole field—the public ownership of the industry, reserves and types of coal, the consumers, present and future problems, manpower, consultation and disputes, exports, prices and costs, science and research. There is also a useful appendix of tables and statistics, which to many will be most helpful for reference purposes.

One of the questions is " What is the Board doing to produce more smokeless fuel?" As the answer is of interest to readers of this journal we may quote it in full:

> " Public awareness of the dangers of atmospheric pollution has grown in recent years, and the demand for smokeless fuels will increase through the implementation of the Clean Air Act, 1956.
>
> " The Board produce some coals such as anthracite which are naturally smokeless; they manufacture coke and ' Phurnacite ' (a smokeless fuel equal in quality to the best grades of anthracite and suitable for closed stoves and heat storage cookers), and pilot plants for two processes to make open-fire smokeless fuels from coal were scheduled to start production towards the end of 1960.
>
> " The ' Phurnacite ' plant in South Wales has been extended, and 645,000 tons of this fuel were produced in 1959 compared with 148,000 tons 10 years earlier. Output of ' Phurnacite ' is limited by the availability of coals of the type suitable for this purpose.
>
> " Much of the work at the Board's Coal Research Establishment in recent years has been directed to research on processes for making new smokeless fuels, mainly for domestic use in open grates or closed appliances, from coals which are more generally available. In 1959 a Process Development Department was set up with the object of developing to the stage of full commercial production processes initiated by scientists at the Research Establishment."

Inquiries about the booklet may be made to the National Coal Board (Public Relations), Hobart House, London, S.W.1.

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**The Queen Mother.**—Queen Elizabeth the Queen Mother will open the new permanent Health Exhibition Centre of the Royal Society of Health on 1st March, 1961. One of the sections of the exhibition will be on clean air.

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**Chronic Bronchitis: A New Film Strip**

A new colour film strip on the scourge of bronchitis has been produced by Diana Wyllie Ltd. with the co-operation of Pfizer Ltd. The lecture notes have been written by one of the Society's Deputy Chairmen, Dr. J. L. Burn, Medical Officer of Health, Salford. Five frames out of thirty are devoted to direct lessons concerning the effects of air pollution and the implementation of the Clean Air Act. There is also an Appendix on Air Pollution attached to the lecture notes. The strip is 35 mm. double frame, and costs £2.

# THE HEADQUARTERS FUND APPEAL

## *Second List of Donations*

The first list of donations was given in our last issue. The following list is for donations received to 30 November, 1960.

**£200.**—British Iron & Steel Federation.

**£125.**—Electricity Council; Gas Council; Central Electricity Generating Board.

**100 guineas.**—NuSwift Ltd.

**£75.**—British Electrical Development Association; North Thames Gas Board.

**50 guineas.**—North Western Gas Board; South Eastern Gas Board.

**£50.**—British Petroleum Co. Ltd.

**40 guineas.**—Corporation of London.

**35 guineas.**—Scottish Gas Board.

**30 guineas.**—Eastern Electricity Board; North Western Electricity Board.

**25 guineas.**—Yorkshire Electricity Board; Lancashire County Council.

**£25.**—National Carbonising Co. Ltd.; Mather & Platt Ltd.; South of Scotland Electricity Board; United Steel Companies Ltd.

**21 guineas.**—London County Council.

**20 guineas.**—Sheffield & District Clean Air Committee; North Eastern Gas Board; Salford Corporation; Cheshire County Council; Southern Electricity Board; Northern Gas Board; Manchester Corporation; Birmingham Corporation; City of Westminster.

**£20.**—East Midlands Electricity Board.

**£18 7s. 6d.**—South Western Gas Board.

**£18.**—Merthyr Tydfil Corporation.

**15 guineas.**—Kingston upon Hull Corporation; Cardiff Corporation; Bedfordshire County Council; North Riding of Yorkshire County Council; Bristol Corporation.

**£15.**—Bradford Corporation; Stoke-on-Trent Corporation; Northumberland County Council.

**12 guineas.**—British Insulated Callender's Cables Ltd.

**10 guineas.**—Woolwich Corporation; Tredegar U.D.C.; Camberwell Corporation; Leeds Corporation; Middlesbrough Corporation; Hackney Corporation; British Medical Association; Wolverhampton Corporation; Twickenham Corporation; South Shields Corporation; Hornchurch U.D.C.; Hammersmith Corporation; Swansea Corporation; Fulham Corporation; Coventry Corporation; Oldham Corporation; Women's Gas Federation; Nottingham Corporation; Newport Corporation; Bolton Corporation; South Western Electricity Board; Clydebank Corporation; Rhondda Corporation; East Ham Corporation; Preston Corporation; Dundee Corporation; Ilford Corporation; Dunbarton C.C.; St. Helens Corporation.

**£10.**—Wrexham R.D.C.; Oxford Corporation; Denton U.D.C.

**9 guineas.**—Rawtenstall Corporation.

**8 guineas.**—Edmonton Corporation; Nuneaton Corporation; Bedford Corporation.

**£7 12s. 6d.**—Sedgley U.D.C.

**£7 10s.**—Chester R.D.C.

**6 guineas.**—Davidson & Co. Ltd.; Rochdale Corporation; Halifax Corporation; Warrington Corporation; Chesterfield R.D.C.; Croydon Corporation; North of Scotland Hydro-Electric Board; West Bromwich Corporation; Rotherham Corporation; Bexley Corporation; Solihull Corporation; Washington U.D.C.; Southwark Corporation; Smethwick Corporation; Sutton & Cheam Corporation; Bath Corporation; Renfrew County Council; Thurrock U.D.C.; Burnley Corporation; Hampstead Corporation.

**5 guineas.**—Doncaster Corporation; Penge U.D.C.; Hove Corporation; Swinton & Pendlebury Corporation; Wandsworth Corporation; Hemsworth U.D.C.; Warwick Corporation; Llanelly R.D.C.; Amersham U.D.C.

**£5.**—Stone R.D.C.; Barrhead Corporation; Blackburn Corporation.

**4 guineas.**—Motherwell & Wishaw Corporation; Inverness County Council;

Cheltenham Corporation; Bermondsey Corporation; Glanford Brigg R.D.C.; Bradford Civic Society; Bethnal Green Corporation; Bury Corporation; Stretford Corporation; Crewe Corporation; Beeston & Stapleford U.D.C.; Crayford U.D.C.; West Hartlepool Corporation; Bromley Corporation; Carshalton U.D.C.; Dursley Corporation; Norwich Corporation; Nelson Corporation; Newcastle-under-Lyme Corporation; Acton Corporation; Chelsea Corporation; Orpington U.D.C.; Mansfield Corporation; Middleton Corporation; Peterborough Corporation; Widnes Corporation; Wakefield Corporation; Finsbury Corporation; Chesterfield Corporation.

**£4.**—Scunthorpe Corporation.

**£3 14s.**—Havant & Waterloo U.D.C.

**£3 10s.**—Darlington Corporation.

**3 guineas.**—Friern Barnet U.D.C.; Cheadle & Gatley U.D.C.; Kettering Corporation; Castleford Corporation; Richmond Corporation; Newburn U.D.C.; Jarrow Corporation; Wednesbury Corporation; Dover Corporation; Bebington Corporation; Sale Corporation; Thornbury R.D.C.; Redcar Corporation; Darwen Corporation; Spenborough Corporation; Guildford Corporation; Long Eaton U.D.C.; Corby U.D.C.; Aberdare U.D.C.; Stockton-on-Tees Corporation; New Forest R.D.C.; Harlow U.D.C.; Falkirk Corporation; Bedwellty U.D.C.; Maidenhead Corporation; Lancaster Corporation; Ashington U.D.C.; Kidderminster Corporation; Cannock U.D.C.; High Wycombe Corporation; Rochester Corporation; Crawley U.D.C.; Staines U.D.C.; Bedworth U.D.C.; Batley Corporation; East Barnet U.D.C.; Hereford Corporation; Neath Corporation; Wrexham Corporation; Cheshunt U.D.C.; Barnes Corporation; Mountain Ash U.D.C.; Meriden U.D.C.; Leamington Spa Corporation; Ellesmere Port Corporation; Hinckley U.D.C.; Kingston upon Thames Corporation; Dunfermline Corporation; Epping & Ongar R.D.C.; Ilkeston Corporation; Shipley U.D.C.; Egham U.D.C.; Radcliffe Corporation; Barry Corporation; Gravesend Corporation; Malden & Coombe Corporation; Burton-on-Trent Corporation; Southwell R.D.C.; Bishop Auckland U.D.C.; Accrington Corporation; Consett U.D.C.; Ayr Corporation; Gelligaer U.D.C.; Bedlingtonshire U.D.C.; Heywood Corporation; Durham Corporation; Brownhills U.D.C.; Willenhall U.D.C.

**£3.**—Worsley U.D.C.; Northfleet U.D.C.; Anon, London.

**£2 18s.**—Mr. and Mrs. C. B. Taylor.

**2½ guineas.**—Adwick-le-Street U.D.C.; Audenshaw U.D.C.; Kirkintilloch Corporation; Wilmslow U.D.C.; Queensbury & Shelf U.D.C.; Bedwas & Machen U.D.C.; Warsop U.D.C.; Kirkcaldy Corporation; Standish-with-Langtree U.D.C.; Otley U.D.C.; Bingley U.D.C.; Bredbury & Romiley U.D.C.; Cwmbran U.D.C.; Irlam U.D.C.; Chester-le-Street U.D.C.; Kearsley U.D.C.; Horsham U.D.C.; Kirkby-in-Ashfield U.D.C.; Kingswood U.D.C.; Hartlepool Corporation; Barnard Castle R.D.C.; St. Pancras Corporation; Bushey U.D.C.; Skelton & Brotton U.D.C.; Boston Corporation; Bacup Corporation; Ryton U.D.C.; Old Fletton U.D.C.; Conisbrough U.D.C.; Middlewich U.D.C.; Sittingbourne & Milton U.D.C.; Church U.D.C.; Worsbrough U.D.C.; Bridlington Corporation; Dursley R.D.C.; Billingham U.D.C.; Royton U.D.C.; Haydock U.D.C.; Denby Dale U.D.C.; Darlaston U.D.C.; Hale U.D.C.

**2 guineas.**—West Lothian County Council; Bingham R.D.C.; Clackmannan County Council; Sowerby Bridge U.D.C.; Hetton U.D.C.; Runcorn R.D.C.; Mitcham Corporation; Gloucester Corporation; Dartford R.D.C.; Stirling County Council; Gainsborough U.D.C.; Dumfries Corporation; Swinton U.D.C.; Hornsey Corporation; Pudsey Corporation; Dr. A. J. Shinnie; Birkenhead Corporation; Caerphilly U.D.C.; Leyton Corporation; Sutton-in-Ashfield U.D.C.; Stalybridge Corporation; Houghton-le-Spring U.D.C.

**£2.**—Lady Cawley.

**£1 15s.**—Meltham U.D.C.

**1½ guineas.**—Kensington Corporation.

**1 guinea.**—Cambridge Corporation; Belper U.D.C.; Colne Valley U.D.C.; Rowley Regis Corporation; Miss D. Boyd; Miss R. Cave; Reigate Corporation; Wood Green Corporation; Mexborough U.D.C.; Luton Corporation; Longdendale U.D.C.; Thornaby-on-Tees Corporation; Mr. J. Goodfellow; Newton-le-Willows U.D.C.

**£1 and less.**—Miss V. Leveson Gower; Dr. J. Dantin Gallego; Mrs. W. Lane.

Total to date: £4,113 1s. 6d.

# THE MEASUREMENT OF AIR POLLUTION

## *1958 Report Published*

**The Investigation of Atmospheric Pollution: Research and Observations in the Year ended March 31st, 1958. Department of Scientific and Industrial Research. H.M. Stationery Office, 8s. net.**

It is understandable that the mass of figures that constitute the major part of this 164 page report should take a considerable time to prepare for publication. The delay is, however, made more apparent by the inclusion of reports, also for the year ended 31st March, 1958, of the now extinct Atmospheric Pollution Research Committee of the (likewise extinct) Fuel Research Board, and of the Director of Fuel Research. Much of the information in these reports has by now been published elsewhere, and such details as the number of co-operating bodies and the number of instruments in use, is more up-to-date, for instance, in the Warren Spring contribution to the N.S.C.A. *Clean Air Year Book* for 1960.

The Research Committee's report, signed by Mr. J. C. Regan, contains one item of useful counter-propaganda information that either has not been published before or has been overlooked by this journal. It is on fumes from coke fires, a perennial prejudice, and may be quoted in full:

> " While the introduction of smoke control areas under the Clean Air Act is leading to a great reduction of smoke by the replacement of coal by coke as a domestic fuel, the fact remains that the amount of sulphur dioxides emitted into the atmosphere is not reduced. Fears have been expressed that with atmospheric conditions unfavourable to dispersion, the smell of these oxides may be objectionable as it will no longer be masked by the smell of smoke. We therefore recommended that arrangements should be made for this to be examined, on days of temperature inversion, in a residential smoke-control area outside Nottingham where the burning of coke provides the main source of domestic heating. We are pleased to report that no smell of oxides of sulphur could be detected."

The detailed figures for the large number of measuring stations are difficult to discuss, but it is at least possible to summarize the tables that give the high, average and low values for deposits, smoke (suspended matter), and sulphur dioxide as measured by the volumetric and the lead peroxide methods. " High " and " low " values are the arithmetic means of the six or seven highest and lowest measurements, averaged over the whole year.

| | *High* | *Average* | *Low* |
|---|---|---|---|
| Deposited Matter (total solids)[1] .. | 4,172 | 674 | 185 |
| Smoke[2] .. .. | 55 | 20 | 2 |
| Sulphur dioxide (volumetric)[3] .. | 13 | 7 | 2 |
| Sulphur dioxide (Lead peroxide)[4] | 9·2 | 1·8 | 0·25 |

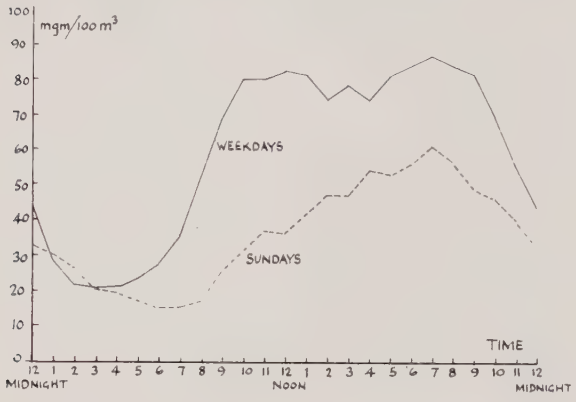
[1] grams per 100 square metres per month.
[2] milligrams per 100 cubic metres.
[3] parts per 100 millions by volume.
[4] milligrams $SO_3$ per 100 cubic metres lead peroxide per day.

This summary demonstrates very clearly the wide gaps that exist between the three groupings, and if we regard the " low " figures as the ideal to which we are moving, the distance to be travelled becomes very apparent.

The report discusses smoke and sulphur dioxide concentrations in the City of London and also the question of smoke emission in populated areas. Both of these matters, however, have been the subject of papers, including that by Pindard and Wilkins at the Llandudno conference of the Society in 1958, and that by Williams at the Harrogate conference, 1960.

On page 96 will be found (Table 18) details of the hourly average of suspended matter (smoke) at five stations.

Such hourly records have been published in the past, and from them instructive graphs can be constructed, showing the daily rise and fall of the pollution in the air. The significance of the differences between, for example, summer and winter, or weekdays and Sundays, can be demonstrated. As an illustration of this we give the curves for Glasgow No. 1 station (Glasgow Cross) for weekdays and Sundays during the six winter months. The Sunday curve can be regarded as being mainly domestic smoke; that for weekdays being domestic and industrial smoke together. It is interesting to note that in both cases the peak is reached at 7 p.m., having built up gradually to this on Sundays. There are unfortunately insufficient examples of such hourly observations available, either now or for earlier periods, but there does seem to be a suggestion that the shape of the curve has altered since pre-war days, when the weekday peak was generally at 8 or 9 a.m., followed by a smaller peak in the evening. The present figures may indicate changes in domestic habits—a reduced use of coal for cooking and room heating in the mornings, but its continued use for room heating in the evenings.




For comparison, the peaks for Glasgow 1 station in the summer months are 60 mgm. per 100 centimetres at 9 a.m. on weekdays, and 24 mgm. at 9 p.m. on Sundays.

# *The G.E.C. Electric Firelighter*

The difficulties that may occur in igniting smokeless fuels by a smokeless method have led to the " Sticks and Paper " order reported in our last issue, the effect of which is to relax smoke control standards, even if only to a limited extent. But if gas is not available and if there are no alternatives the order can be useful. We have reported on several occasions, over the years, on claims about electric firelighters, but up to recently these have not proved successful. A device depending on the insertion of a heated element into the fuel never seemed likely to succeed because of the obvious overheating and damage that could so easily occur. The new firelighter described in our Summer, 1960 issue (No. 114) is on a quite different principle, as is the appliance that has recently been convincingly demonstrated by the General Electric Co. Ltd.

This depends on blowing very hot air into the fire, and it is only necessary for the end of the nozzle to be in or against the fuel bed. The air temperature is 800°C. and will ignite bituminous coal of good quality in $1\frac{1}{2}$ to 4 minutes, and smokeless fuels in 6 to 15 minutes, according to reactivity. It can be used with any type of open fire and with stoves and domestic boilers (provided that in the latter the opening, designed primarily to take a gas poker, is large enough for the entry of the nozzle—a point in design that manufacturers should now note).

**How it Works**

The firelighter has a fan, similar to that used in a domestic hair-dryer, which blows air over a 1,800 watt heating element, the coils of which raise the temperature to about 800°C. at the exit. Safety has been well considered and is a major feature of



*The electric firelighter in use*

design. To prevent accidental switching on, and to avoid misuse by children, the lighter will only operate by the use of a key. The " barrel " consists of three tubes: a primary ceramic air flow tube with holes through the wall arranged to carry the heater coils, and with four longitudinal ribs which support it in the secondary air flow tube, a light gauge welded steel tube; and thirdly an outer air flow tube finished in a hammer texture stove enamel. This outer case is cooled by passing a jet of cold air between it and the inner element tube. The barrel remains at a safe temperature when the lighter is in use and the carrying handle is always cool. The nozzle is of pressed steel and is provided with secondary ports, to discharge the air from the inner steel tube. The nozzle is finished in heat-resisting aluminium paint and is replaceable if damaged.

After the fuel has ignited the element is switched off and only cold air is delivered to fan the fire. This also cools the nozzle so that it may be removed from the grate cool.

The firelighter is now obtainable from Electricity Boards at a price of about £5. As the running cost is only a little more than 2d. per hour it can be seen that it will light a number of fires, varying according to the fuel, for 1d. Among incidental benefits it is claimed that it is cheaper to light a cigarette with the firelighter than to strike a match!

This firelighter is definitely effective, safe and economical in use. The main hurdles it has to clear to achieve wide acceptability would appear to be the initial cost and the appliance's novel and perhaps rather formidable appearance—both of which can be dealt with by the right publicity and familiarization.

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**Black Market?**

" As the owner of a small do-it-yourself shop in an area with a fair sprinkling of coal merchants, I was amazed when a representative called urging me to sell coal. Doubtless they are worried about their huge stock; but how could I sell coal in a smokeless zone? "—*Reader's letter, Evening Standard.*

# REPORTING GAS PROGRESS

**Annual Report and Accounts 1959-60. H.M. Stationery Office, 9s. 6d. net.**

The Annual Report of the Gas Council, giving an account of its own activities and the trading results of the twelve statutory Area Boards shows that the industry as a whole, for the year ending March 31st, 1960, made a loss of £2,376,521 after charging £27,425,574 for depreciation and £22,956,873 for interest. Six of the Boards—Northern, East Midland, West Midland, Wales, North Thames and Southern made a profit, while six —Scottish, North-Western, North-Eastern, Eastern, South-Eastern and South-Western made a loss on the year's activities. Gas sold amounted to 2,591 million therms, at an average price of 20·8d. per therm; home sales of coke and breeze amounted to 9,360,000 tons and export sales to 904,000 tons. Consumers of gas at March 31st, 1960, numbered 12,882,865 of whom 12,145,277 were domestic consumers.

The industry used 22,317,000 tons of coal and 750,000 tons of oil in gas manufacture.

New gas-making plant of a capacity of 54 million cubic feet a day was brought into commission during the year and plant of a capacity of 75 million cubic feet a day was scrapped. Of the new plant, 29 million cubic feet a day was for gasification of oil. Progress continues in closing down the smaller inefficient stations. Production ceased at a further 35 stations, supplies being provided from the larger and more efficient 428 works that remain out of the 1,050 works taken over at vesting date.

### Sources of Gas-supply

Some fifth of the gas supplied by the Area Boards is purchased from outside sources, from coke ovens of the National Coal Board and the Iron and Steel Industry, to an increasing extent from the oil refining industry, and also methane gas recovered from coal mines. The 2,800 million therms of the total supply includes 1,727 million therms of coal gas, 404 million therms of water gas, and 100 million therms of oil and other gas. As the stock of coke has been excessive, the Boards have made less coke by carbonizing less coal, and have used more coke by maintaining a high level of water gas manufacture.

### Coke and Breeze

During the year the Area Boards produced 9·9 million tons of coke and 2·5 million tons of breeze, excluding the coke and breeze used for heating retorts. Some 1·6 million tons of coke and ·8 million tons of breeze were now in gas works for water gas manufacture, steam-raising and other purposes, leaving for sale 8·3 million tons of coke and 1·7 million tons of breeze. A total of 2·2 million tons of coke remained in stock on March 31st, 1960.

In reducing manufacture of coke Area Boards have taken into consideration the requirements of solid smokeless fuels for smoke-control areas under the Clean Air Act, 1956, and are adjusting their make of coke to a quantity which they believe can be sold with the assurance that stocks provide a sufficient reserve to meet any sudden increase in demand.

### Domestic Cokes

The British Standards Institution published on December 23rd, 1959, Standard Specification No. 3142 Part I "Cokes for Domestic Open Fires" providing for two types of high class open fire coke, covering moisture content, size analysis and fire performance tests involving ease of ignition and radiation output. An additional standard dealing with solid smokeless fuels for use in closed domestic appliances and with specially reactive solid smokeless fuels for use in open fires will be issued in due

course. The manufacture of "Cleanglow" was introduced in January 1960 by the East Midland Gas Board. Open fire cokes were produced to the quality requirements of B.S.3142 and sold as "Gloco" or "Sebrite" by the North Thames, Eastern, South-Eastern, Southern and South-Western Gas Boards.

### Coke-Burning Appliances

The sixth edition of the Gas Council's coke-burning Appliances Handbook was published in November 1959 in loose-leaf form, giving detail of over 400 tested and approved coke-burning appliances. The Domestic Solid Fuel Appliances Approval Council comprising representatives of the Ministry of Power, the National Coal Board, the British Coking Industry Association, the British Ironfounders' Association and the Gas Council completed its first year's work on March 31st, 1960. Both for the Handbook of the Gas Council and for the Domestic Solid Fuel Appliances Approval Council, the methods of tests and the performance standards used are based on standards prepared by the Solid Fuel Appliances Committees of the British Standards Institution.

### Research

A programme of research is supplied by the Gas Council in consultation with the Minister, and is carried out at the Council's Research Stations at Fulham and Solihull, by some Area Boards and at some University Departments. The research programme is directed to the production of gas, the purification of gas and treatment of its by-products, and the utilization of gas. The objective is to produce from coal or oil as raw materials, gas at atmospheric pressure or at high pressure of say, twenty atmospheres. In purification the main objectives are the reduction of the carbon monoxide content of the gas and the removal of the carbon dioxide so formed, and the removal of hydrogen sulphide from the gas. Attention has also been directed to the recovery of sulphur from the waste gases of purification processes. Research has been directed to obtaining data on domestic fuel consumption in cooking, space-heating, and hot water appliances. A gas cooker for people handicapped physically or mentally has been evolved. Attention is also being directed to the storage of gas underground.

### Domestic, Commercial and Industrial Development

During the year there were supplied 795 thousand cookers, 232 thousand water heaters, 244 thousand space heaters, 182 thousand wash boilers and washing machines and 88 thousand refrigerators. The space heaters included some 10 thousand gas-fired central-heating installations and over three thousand warm air space-heating units. Special attention has been given to the best method of installing convector fires to ensure controlled ventilation of the room. In the commercial field development has been in the direction of central-heating units, warm-air heaters and combined warm air and water heating appliances. A gas incinerator for hospitals, offices and flats is being developed. Sales of gas to industrial consumers increased during the year by 6·4 per cent. and attention has been given to new designs of tunnel ovens, and many other appliances. In many instances, conversion of old plant to gas has resulted in economy and increased efficiency.

### Mains

One thousand, eight hundred and sixty-seven miles of mains were laid during the year largely for bulk transmission and integration, bringing the total mileage to 95,645 miles.

### Area Boards

The first stage of the Lurgi gasification plant in Fife is nearing completion and a further section of the associated

high pressure main including the underwater crossing of the Forth has been completed.

In the Northern Area, underground storage facilities have proved satisfactory, and the grid has been supplemented by further links enabling Durham to be supplied from the South.

In the North-West 46 works out of the 104 originally in operation are now meeting the needs of the area. A system of liquid purification in which sulphur is eventually removed by filtration has been in operation.

In the North-East arrangements have been made to purchase the natural gas in Eskdale, for transmission under its own pressure to Whitby.

In the East Midland Area 73 works of the original 104 have now been closed. Owing to the depressed state of the coke industry, the Silverwood coke ovens which supplied the Board with 3·1 million cubic feet of gas a day have been closed.

West Midland Board is completing its Lurgi complete gasification plant at Coleshill. Further supplies of methane were supplied to Etruria from collieries.

The Wales Board sent out 109·48 million therms of gas, including 88·65 million therms from coke ovens, 5·6 million therms from mines and 13·61 million therms were made.

In the Eastern Area a new carbonizing plant at St. Albans has been modified to produce "Cleanglow" smokeless fuel. Six works were closed during the year.

The North Thames Board has continued the trial importation of liquid methane. Increased supplies of refinery gas were received from Shellhaven and Coryton.

In the South-Eastern Area Segas plants at the Isle of Grain are now operating on heavy fuel oil and refinery gas.

The Southern Board has completed the "Backbone Main" from Poole to Oxford. This with the main connecting Portsmouth to Southampton connects all the Board's principal works. Eight works remain in operation of the 62 taken over at vesting date.

In the South-Western Area the North Devon and Dartmoor group is being connected to Exeter and the Minehead and Watchet works with Bridgwater. Seventy-nine out of the 108 works taken over have now been closed. *A.J.C.*

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**Healthy Rash.**—"Whilst it may not yet be commonplace, in many localities lamp-posts and hoardings are breaking out in a rash of notices announcing the impending introduction of a smoke control area for a particular district. . . . Against this background a work of reference which plumbers could usefully keep by them is the 1960 Year Book, published by the National Society for Clean Air. . . ."—*The Plumbing Trade Journal, August*, 1960.

**Cleaner Air in Glasgow**

Glasgow's Medical Officer of Health, Dr. William A. Horne, reports that the attempt to purify the City's air is beginning to show results. The smoke-free area in the centre of Glasgow is still small but a cleaner atmosphere is already apparent. Local householders have co-operated well in changing over to smokeless fuels.

**Miners Want Smokeless Fuel Issue**

The problems of miners' concessionary house coal was mentioned by Mr. Will Whitehead, the South Wales Miners' President, in the Union's monthly, *The Miner*.

Mr. Whitehead writes that the Union has argued that smokeless fuel in quantities equal to the coal now supplied should be conceded to the miners. The Board considered that all that could be expected of it was that an amount of smokeless fuel equal in value to the concessionary coal should be available.

Mr. Whitehead says "As smokeless fuel costs from £11 to £12 a ton, this would mean a considerable reduction in the quantity of fuel supplied."

**Possible WHO Survey in Belfast**

World Health Organization experts have recently visited Belfast to discuss a major air pollution survey, although no final decision has been made as to when the study will take place. The WHO team is expected to visit Belfast again to discuss further details of the scheme. The operation would be financed by WHO.

# NEWS FROM THE DIVISIONS

Members of the **Yorkshire Divisional Council** on the Society paid a visit to the Park Foundry of Radiation at Belper, Derbyshire, on September 8th, where a series of Parkray convector fires and room heaters was on display. A business meeting was held followed by a tour of the production department, showrooms and laboratories. The visitors were shown current Parkray appliances, among them the new Parkray 10 boiler flue set with its " clean air " inset fire. There was on display the special conversion unit which Radiation Limited have made for Yorkist range. Models shortly to go into production were also on view. The visit closed with a discussion on the effectiveness of coke fuel for room heating in approved appliances, which the Chairman of the Division, Mr. A. C. Saword, Chief Public Health Inspector, Hull, said was one of the most useful meetings the Council had ever had. Mr. Saword and his Colleagues on the Council were welcomed to Park Foundry by Mr. R. M. Kirkam on behalf of the Solid Fuel Division of Radiation Group Sales Limited.

On October 21st the **East Midlands Division** of the Society met in Cambridge. 60 delegates attended and spent the morning touring the colleges. They were welcomed to the City by the Mayor (Councillor C. A. Mole) in the afternoon. In a short speech the Mayor commented that although there was no comparison between Cambridge and industrial towns, Cambridge did have a responsibility towards its beautiful buildings. He also mentioned diesel fumes from heavy vehicles being a source for annoyance and danger to other road users.

Three short films on oil uses were shown and Mr. L. P. Draper, of Shell-Mex, spoke on " Chimney Emissions from Oil Fired Plants."

The problems of preventing air pollution in iron founding areas were discussed at a meeting of the **West Midlands Division** at Willenhall on November 17th. In a paper, " Clean Air and the Ironfounder " Mr. A. Archer, Chief Public Health Inspector for Halesowen, examined the problem of the emission of grit, dust, smoke and fumes from iron foundries. He claimed that Local authorities were not implementing the Clean Air Act in industry as vigorously as they should, but were concentrating their energies on the serious domestic problem. There was no unity among local authorities in the way they dealt with the problem, he said, and suggested it should be examined by a technical committee formed by representatives of the industry, Public Health Inspectors and Factory Inspectors.

The Committee should make recommendations to the industry and local authorities, and suggest a time limit within which readjustment should be completed.

Mr. M. E. Hunter, a Director of Court Works, Madeley, said that industrialists were just as interested in clean air as local authorites. He did not believe more regulations were necessary. Co-operation between industrialists and the authorities, not dictation, was essential.

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**Puffs of Smoke Rise Better**

According to a Report in the *New Scientist* of 1st September smoke and fumes forced from chimneys in discrete puffs and at high velocity are likely to rise to a greater height in a calm atmosphere than if simply the overall momentum of the smoke is increased. This is one of the main conclusions reached by Dr. J. S. Turner during recent laboratory experiments at the University of Manchester. His work suggests a method of removing noxious gases to a safe height without mixing into the atmosphere at lower levels. Whether this method will prove economic depends upon the expense, inconvenience incurred in storing hot gases, and on the possibility of devising a valve system capable of releasing hot gas from a chimney several feet in diameter during the period of about one second.

# *Heating the Home*

## *A Book that Succeeds*

**Domestic Heating. Edited by W. F. B. Shaw, pp. 194, with 49 figures. Temple Press Ltd., London, 21s. net.**

This new book admirably succeeds in what it sets out to do, and is the most useful we have seen on a subject that has rarely been dealt with satisfactorily, despite the fact that in one way or another it concerns everyone. It is easy to write at length about all and every aspect of domestic heating — as witness the constant articles in the popular press and the home and women's magazines—but it is not easy to treat it comprehensively, to keep all the many factors and alternatives in their correct perspective and proportions, and to betray no bias towards this or against that. It is likewise not easy to steer a way between the technical text-book of limited interest, and an approach that is popular but of little practical value.

This book, ably edited by W. B. F. Shaw of the Warren Spring Laboratory, with the collaboration of a number of specialists, avoids these pitfalls and gives a complete, well-balanced and readable survey of the whole field of domestic heating. The experts deal with their own kinds of heating, while the editor contributes chapters that review and compare them in a fair and independent manner. Thus Mr. Shaw deals with the selection of a suitable heating system, the questions of comfort and safety, the choice of fuels, and the selection of appliances. The other writers cover insulation and ventilation, domestic heating with solid fuel, gas, electricity, and oil.

As one example of the approach that is used mention may be made of a tabulated list that gives the advantages and disadvantages of the different fuels. There is also a table showing the cost per useful therm for various combinations of fuels and appliances. This is very similar, both in classification and in figures—with slight variations—to the table published in the January, 1960, issue of *Which?*, by the Consumers' Association Ltd.

The specialist contributors, being naturally well-informed and up-to-date in their particular fields, are able to explain and give details of the newer methods of heating, such as electric floor warming and storage heaters, the small bore central heating and the ducted warm air systems, using solid fuel, gas or oil. Both space heating and water heating are covered, but not cooking.

The book is not technical, in the text-book sense, but it does contain a great deal of what is essentially technical information. It is intended primarily, says a cover note "as a guide and source of information for householders contemplating installation of new heating systems or appliances, or conversion of existing systems," and "should also prove of considerable value to architects and builders." We agree, and would add that it should also be of value to local authority officers concerned with the establishment of smoke control areas.

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**World Health Organization Committee Discusses Air Pollution**

The Tenth Session of the Regional Committee for Europe of the WHO took place at Christiansborg Castle, Copenhagen, from 16th–20th August. In his annual report Dr. P. J. J. van D. Calseyde, Regional Director for Europe, states that housing, air pollution, standards of drinking water, dental services for children, protection from atomic radiation, improved vaccines, better and cleaner milk are some of the topics on which the WHO European Office is working at the request of European governments. Standardization of instruments for measuring air pollution, and methods of analysis are a first step in the work on air pollution, together with statistical studies of respiratory diseases in different European countries. Model legislation and technique of controlling air pollution are also planned.

# AIR POLLUTION ABSTRACTS

*Special Section on Harrogate Conference Papers*

**467. Administrative Control of Smoke from Road Vehicles, The.** Lister, D. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). Visible smoke from road vehicles is taken notice of by the law, while the invisible cannot yet be dealt with technically and therefore does not come under the law. Heavy black smoke appears to come from comparatively few offenders, more actual pollution coming from those vehicles emitting a moderately heavy smoke. Legal power is needed if a really effective clean up is to be secured. The present law is difficult to enforce, because of the need to prove damage or danger, but the police are increasing the number of cases they are taking to court. There is a need for a standard similar to the Ringelmann chart. The Ringelmann chart is used in the State of California, and Air Pollution Control Officers are used to enforce law. They are also used in Durban, operating via Police. The use of the Ringelmann chart presents difficulties and the use of the Hartridge smoke meter or the Bosch instrument using filter paper is discussed. In Durban the law is enforced by removing the clearance certificate of a vehicle until the smoke causing fault is remedied.

**468. Prevention of Air Pollution by Diesel-Engined Road Vehicles.** Waring, G. J. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). It is necessary for the diesel engineer to design his engine so as to reduce smoke emission, for both economic and amenity reasons. There is need for a means of measuring smoke emission and for a standard of smoke acceptability. The Hartridge smoke meter fulfills the need for an instrument which gives an instantaneous reading, is portable and does not rely on special services for operation. It operates by measuring the obscuration of a beam of light falling on a photocell. Other forms of smoke-meter working on the filtration principle are not so convenient, although they do have the advantage of making a permanent record. Diesel engines have limiting points of clean running which can be reached by reducing the engine speed or fuel quantity. The poor combustion which gives rise to smoke can be the result of a number of factors such as faulty injection equipment, lack of cylinder compression and interference with the air breathing of the engine. The paper describes these faults in some detail.

**469. Some Factors Concerning Diesel Engine Exhaust Smoke.** Lock, J. K. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). The paper considers the possible reasons for the emission of black exhaust smoke from automobile diesel engines. The principal reasons are: (1) too great a quantity of fuel being delivered by the high pressure pump into the engine, or (2) malfunctioning of the fuel injectors. Evidence of the effect of these factors on exhaust smoke is presented. Both of these factors are thought to be due to poor maintenance, particularly of the fuel injection equipment. Investigations have been carried out into the effect of changes in fuel quality on exhaust smoke, and it is shown that while large changes in fuel quality can produce small changes in exhaust, the changes permissible within the acceptable marketing specification are only small. The effect of mechanical factors discussed above is of greater importance.

**470. Methods of Removing Smoke from the Exhaust Gases of Diesel-Engines.** Reed, L. E. and Wallin, S. C. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). The diesel engine, despite its efficiency, has a reputation for being a source of one of the worst forms of pollution because of its emission of black smoke, formed by unburned fuel. Most of the emission is a result of such factors as poor maintenance, but if a device could be found to prevent smoke being emitted, it would make a useful contribution to the reduction of air pollution. Cyclone cleaners, combustion (either catalytic or non-catalytic), filtration and scrubbing, were considered as means of removing smoke from exhaust gases, and experimental works carried out on some of them. A single cylinder stationary engine and a six cylinder engine in a ten-ton vehicle were used for the experiments. Cyclones were not experimented with, as their efficiency is extremely low with small particles as found in diesel smoke. Non-catalytic combustion needed too high a

temperature and catalytic combustion was ineffective. No suitable filtering medium could be found, nor could any effective scrubbing device. All methods which were capable of effecting a substantial reduction would be costly in operation, and none were considered satisfactory for road transport. It is concluded that more emphasis should be given to the prevention of smoke than to devising methods of removing it.

**471. Assessment of Liability to Smog in Terms of Weather, The.** Meade, P. J. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). Serious pollution associated with smog conditions occurs with weather of a quiet, anticyclonic type. The incidents of such weather during five consecutive winters has been investigated for 25 towns fairly well distributed over Great Britain. Figures are given which show for each town the total number of days with quiet, anticyclonic weather and also the number of occasions when this type of weather persisted for spells of two, three, four or more days. It is suggested that this analysis could lead to a more comprehensive investigation aimed at assessing the relative liabilities of various towns to periods of serious pollution.

**472. Work of the Central Electricity Generating Board Concerning Atmospheric Pollution Conditions around Power Stations, The.** Jarvis, W. D. and Wilson, D. S. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). The Central Electricity Generating Board has conducted surveys to determine the effect of the emissions from Power Stations on the general level of pollutions in the vicinity of the stations. The results of the monthly observations published by the D.S.I.R. have been recorded on punched cards for machine sorting. The results show that the national level of dust concentration has fallen considerably since 1950, but the $SO_2$ concentration has increased since 1952. The effect of Power Stations on the level of $SO_2$ pollution was shown to be small, even in relation to rural levels of emission. Short period surveys also showed that no serious concentration occurred in good weather. Other types of survey are also being conducted concerning chimney height and inversion conditions. Improvements to reduce emissions are being developed and introduced, and older power stations are being closed down and new ones are commissioned. Problems arising from oil firing are also being dealt with.

**473. Sampling for 3:4 Benzpyrene from Continuous Combustion Appliances fired by Petroleum Fuels.** Howe, E. L. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). In recent years attention has been drawn to the possibility of 3:4 benzpyrene, a trace decomposition product resulting from incomplete combustion which may be present in smoke, being a cause of cancer in humans and animals. As part of a programme to investigate the composition of flue gases from continuous combustion plant, fired by petroleum fuels, measurements have been made for 3:4 benzpyrene. Appliances ranging in size from a simple cooking-ring, using liquefied petroleum gas, to a water tube boiler, using heavy fuel oil, have been tested. It is shown that in all cases the 3:4 benzpyrene content of sampled solids and " oil " was less than the limit of detection by analytical method employed, i.e. less than one microgramme. This means that the quantity of 3:4 benzpyrene emitted from continuous combustion plant, fired by petroleum fuel, is likely to be less than 0·006 parts per million of fuel burnt.

**474. Trends in the Pollution of the Air of Great Britain by Smoke and Sulphur Dioxide, 1952–1959.** Carroll, J. D. et al. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). An attempt is made in this paper to estimate changes in the emission of smoke and sulphur dioxide into the air of this country during the period 1952–59, and to see to what extent they are reflected in changes in the concentration of these pollutants near ground level, at least, as far as such changes can be estimated from the data obtained by the D.S.I.R. Co-operative Investigation of Atmospheric Pollution. One of the factors concerned in bringing about such changes is the Clean Air Act, which came into force in 1956 and which has curbed the emission of smoke but has no direct effect on pollution by sulphur dioxide.

**475. Pollution Levels in Cities.** Williams, F. P. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). A study of air pollution measurements provided by the D.S.I.R. Co-operative Investigation of Atmospheric Pollution shows that the concentration of pollution is independent of the size of towns. Smoke pollution at any

point depends on the density of the population, and on the coal consumption per head of population, in a relatively small area surrounding that point. For 68 sites in the Yorkshire and London areas, a close correlation was found between smoke concentration and the domestic coal consumption per square mile, with a highly significant correlation coefficient of plus 0·647. The domestic contribution to smoke pollution measured at low level is estimated at over 80 per cent, for most urban areas.

**476. Measurement of Atmospheric Pollution: The Accuracy of the Instruments and the Significance of the Results, The.** Craxford, S. R. et al. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). The performance of the instruments in common use in this country for the measurement of atmospheric pollution is being investigated and this paper is a progress report, presenting data on their reliability and accuracy, and on possible errors inherent in them. It is intended as an interim guide to the interpretation of the results obtained with these instruments.

**477. Report on the B.S. Coke.** Cooke, J. O. and Eaton, F. J. (Proc. N.C.S.A. Annual Conference, Harrogate, 1960). The paper outlines the experience of the gas industry in the production and marketing of coke to B.S. 3142 and of the specially reactive domestic smokeless fuels such as Cleanglow and Phimax.

**478. Smoke Control in Action: Thirteen Years' Experience in Bradford.** Wilson, D. G. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). In Bradford since 1946 it has been the policy of the local authority to prohibit the emissions of smoke by tenancy agreement in all its post-war housing estates. There is consequently a history of 14 years operation of smoke control. In 1959 a sample survey was conducted to find out the views of householders. A very large percentage of households were found to rely on open fires for space and water heating. Gas ignition was used in most cases. There was a high level of satisfaction with the heating arrangements and with coke as a fuel. Most obtained their supplies from a merchant's roundsman. Although there was general approval for coke on grounds of cleanliness, heat value and the minimum trouble, paradoxically about 30 per cent said they would return to coal.

**479. Modification of Side-Oven Ranges by means of Conversion Units, The.** Baxendale, J. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). In some northern and midland districts the cost of conversion of solid fuel side-oven ranges is a factor working against the introduction of smoke control areas, as such conversions may cost up to £50. Conversion units have been developed which are satisfactory for installation on most types of solid fuel ranges. The unit is an orthodox solid smokeless fuel appliance minus the frame for holding the bottom grate. The installation and other details of the unit are described. As the conversion unit is not an approved appliance, discussions were held with Government departments regarding grants under the Clean Air Act and it was finally agreed that the Minister will authorize grants on all installations provided that the installing contractor was prepared to give a certificate to the Local Authority concerned that the appliance would prove satisfactory in operation on the type of coke available in the area concerned. Before the granting of such a certificate a number of test installations have been made in proposed smoke control areas. After a preliminary period of training and climatization a high level of consumer satisfaction has been recorded. The cost of such conversions is between £9 and £11.

**480. Recent Developments in the Use of Gas for Domestic Heating.** Fuidge, G. H. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). The use of gas for domestic heating has increased rapidly. This is due to demand for higher standards of heating and labour saving, but is also due to technical developments in gas appliances. Gas fire efficiencies of 75 per cent, are now attainable by sealing the combustion chamber. The demand for gas central heating by hot water has greatly increased, especially using the small bore system. Warmed air heating, either with direct gas-to-air heat exchange, or via a hot water boiler, is also being widely installed. The problem of venting the products of combustion in a high building has now been solved by the use of the branched or " shunt " flue. The problem of exhaust products is also made easier by the use of a sealed combustion chamber having inlets and outlets through an outside wall, terminated in such a way that the wind effects are " balanced " between inlet and outlet and do not affect the performance of the appliance, which

is therefore known as a " balanced fuel appliance." The installation of these balanced appliances in a tall building is also facilitated by the use of a " Se-duct," which consists of a simple common flue open at both ends.

**481. Dust Sampling Provide Pollution Control.** Lees, B. and Morley, M. C. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). A sampler has been developed for routine assessment of the dust and grit emitted from boilers and other industrial plant. The sampler is extremely simple, yields consistent results and routine tests occupy only a few minutes per day. It is shown how the grit and dust burden from arresters may be many times higher than " standard " if the plant is not tested regularly. It is recommended that all large dust arresting units and also some industrial boilers and industrial plant without arresters should be fitted with a means of regularly measuring dust and grit emissions.

**482. Prevention of Smuts with Oil-Fired Boilers at Low-Loads.** Squirrell, F. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). Low-load conditions may give rise to smoke and smut emissions from oil-fired boilers. This is consequent upon the inherent efficiency of an oil-fired boiler and the result in low temperatures of the flue gases. It is suggested that this problem can be overcome by running the burners with restricted turn down, and using the boiler as a thermal storage unit. This can be done by means of gas-tight sealing units at the boiler outlet which close as soon as the burners cut out, and open again just before the burners cut in. The heat is thus sealed in and the burners operate at their most effective rate.

**483. National Coal Board Technical Service and the Clean Air Act.** Harrison, Slade, A. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). The N.C.B. Technical Service arose largely to meet the competition of oil and the needs of consumers for assistance in meeting the Clean Air Act. Its scope is to provide up-to-date information about coal-burning equipment, the availability of suitable qualities of coal and the opportunities of using it without infringing the Act. The country is divided into nine sales regions in which are both commercial and technical representatives. The service's work in connection with section I of the Act deals with many of the causes of emission and thus assists the Smoke Inspectors, who are left free to deal with more wilful offenders. The service is assisting local authorities and industrialists with advice concerning temporary exemptions under section I and permanent exemptions under section II of the Act. The technical staff of the service is assisting consumers to avoid making a nuisance by emitting grit and dust. For pulverized fuel firing it is felt that there is a pressing need for a dust extractor considerably cheaper than the electrostatic precipitator. The technical service has been greatly encouraged by its reception and tends to improve as far as practicable.

**484. Measurement of Dust Emission from Steel Making Furnaces.** Christie, D. H. et al. (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). New processes of iron and steel making have created new dust emission problems. The monitoring of these emissions is necessary for the design of fine fume cleaners and the paper describes work carried out by the United Steel Companies. Concentrations of dust have been estimated by means of optical density measurements, using a smoke density meter and the results are presented graphically on what is called an obscurogram.

**485. Inquiry into the Working of the Clean Air Act: Reports on the Questionnaire. Part I the Domestic and General Aspects. Turner, W. C. Part II the Industrial Aspects. Birtwisle, E. M.** (Proc. N.S.C.A. Annual Conference, Harrogate, 1960). These two papers describe the results of a questionnaire sent to all local authorities in England, Wales and Scotland by the National Society for Clean Air. 60·8 per cent of the authorities circularized submitted replies, including 100 per cent from metropolitan boroughs and Scottish counties of cities and over 95 per cent from " black areas." The first paper draws attention to the disappointing number of smoke control areas introduced up to the date of the returns, and the hope is expressed that this is merely an indication of a slow start due to the size of the problem, in newness of the administrative procedure and the possibility of staff shortages. There are signs that activity in pursuance of the Clean Air Act is gaining momentum but progress will have to be accelerated if the black areas are to be dealt with in the next few years. There is a feeling that the installation of approved appliances prior

to a smoke control order, with an undertaking to burn authorized fuels, should rank for improvement grants. The majority of Local Authorities are making smoke control areas to include more than 500 premises. The majority of authorities use qualified Public Health Inspectors for the work involved. Concessionary coal as a difficulty in creating smoke control areas is a serious problem in only a few districts. Some exemptions are being given for the burning of waste materials in unsuitable appliances and in crude incinerators or in the open. The burning of garden refuse has given rise to some difficulty. Much interest has been shown in the proper wording and interpretation of Model Byelaws. Publicity is being very widely used by local authorities both by themselves and in co-operation with other bodies. The attitude of the Press is very favourable. In Part II the industrial aspects were reported on. A large number of local authorities indicated in their returns that there were no contraventions by industrialists. This is thought to show that the Act is not yet being fully implemented rather than that there are no contraventions. Where prosecutions have been undertaken a very high proportion have been successful. Many local authorities are suggesting the amendment of the dark smoke regulations and the implications of this are discussed. The returns are reported as showing that there are a number of occasions on which plant has been installed without notification of the installation to the local authority. The reasons for this lack of notification, such as the nature of the wording of the Act, are discussed. After reviewing the sections relating to prior approval and its procedure and to grit and dust, the report discusses the information about difficulties of local health officers when approving the height of new chimneys. Various courses of action are suggested. Smoke nuisances, publicity and the training of boiler operators is discussed and the paper concludes that the returns indicate that a reasonable attempt is being made by many authorities and health officers to implement the industrial provisions of the Clean Air Act.

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**Sulphur Control.**—According to Press reports Manchester Corporation legal experts are considering the possibility of introducing in the city's next parliamentary bill provisions to control or reduce sulphur dioxide emissions.

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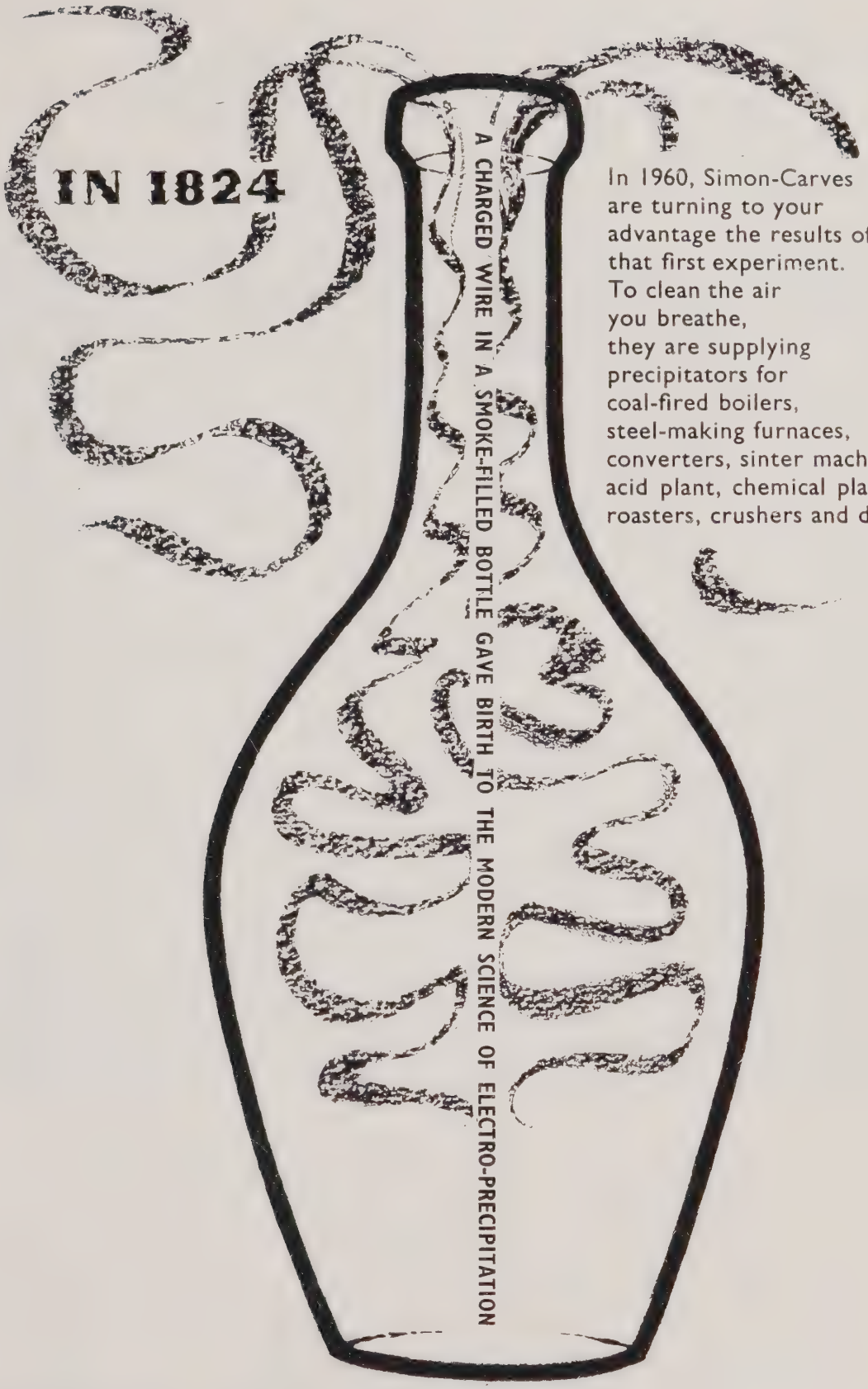
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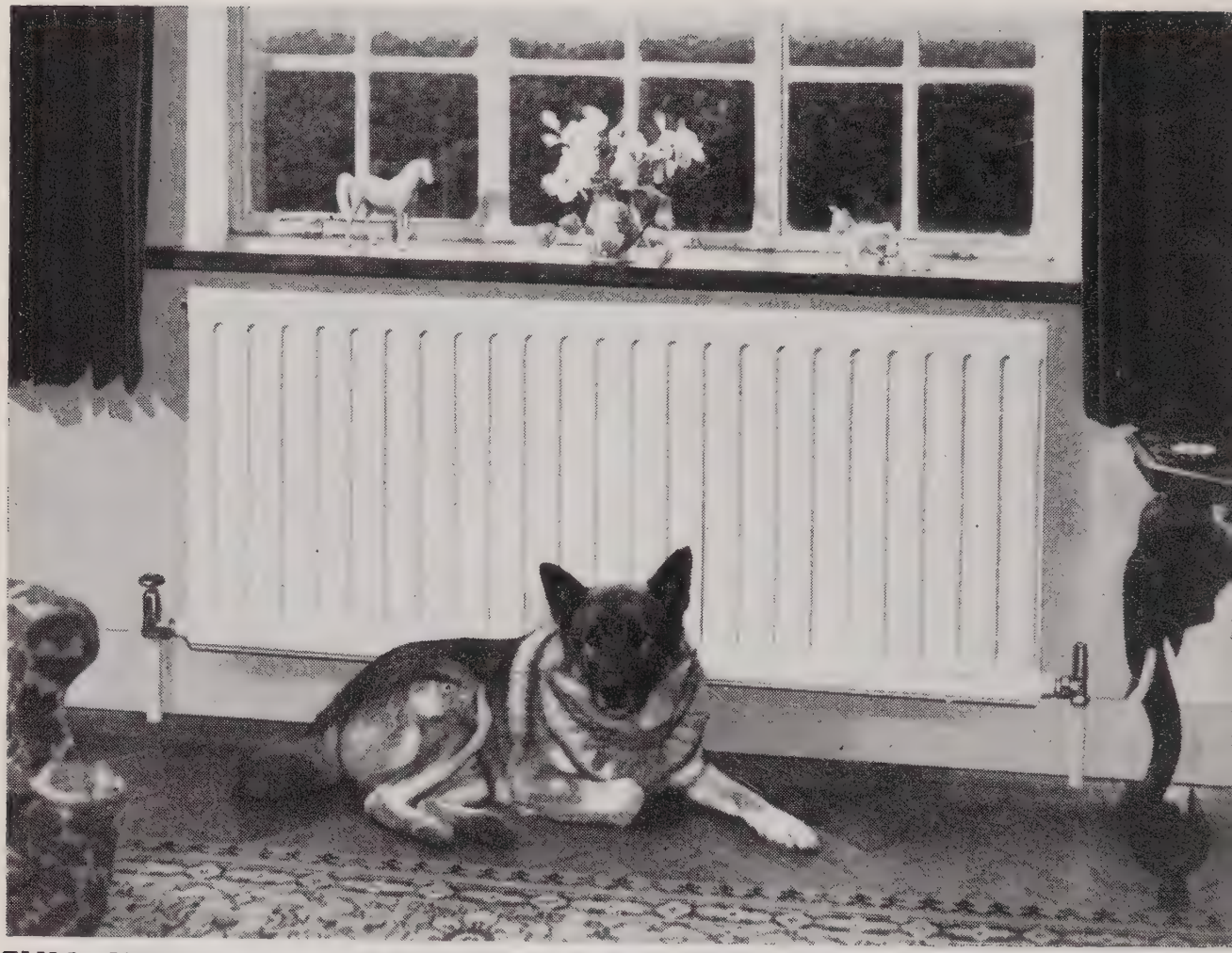
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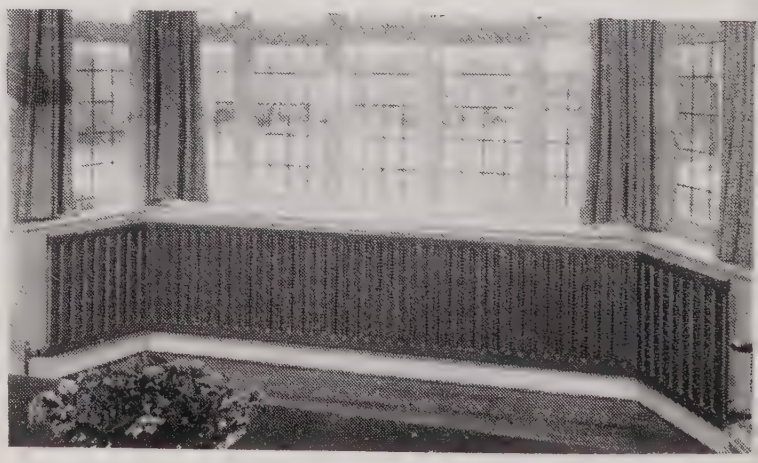
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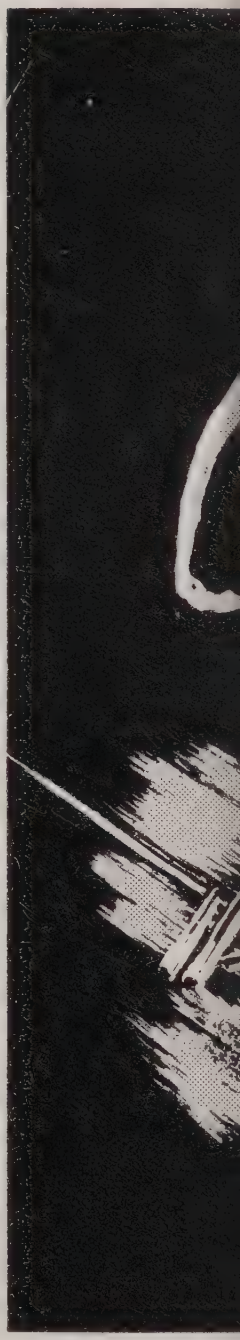
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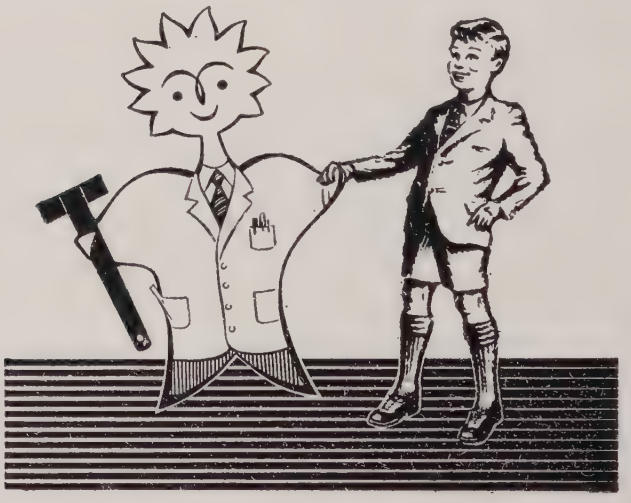
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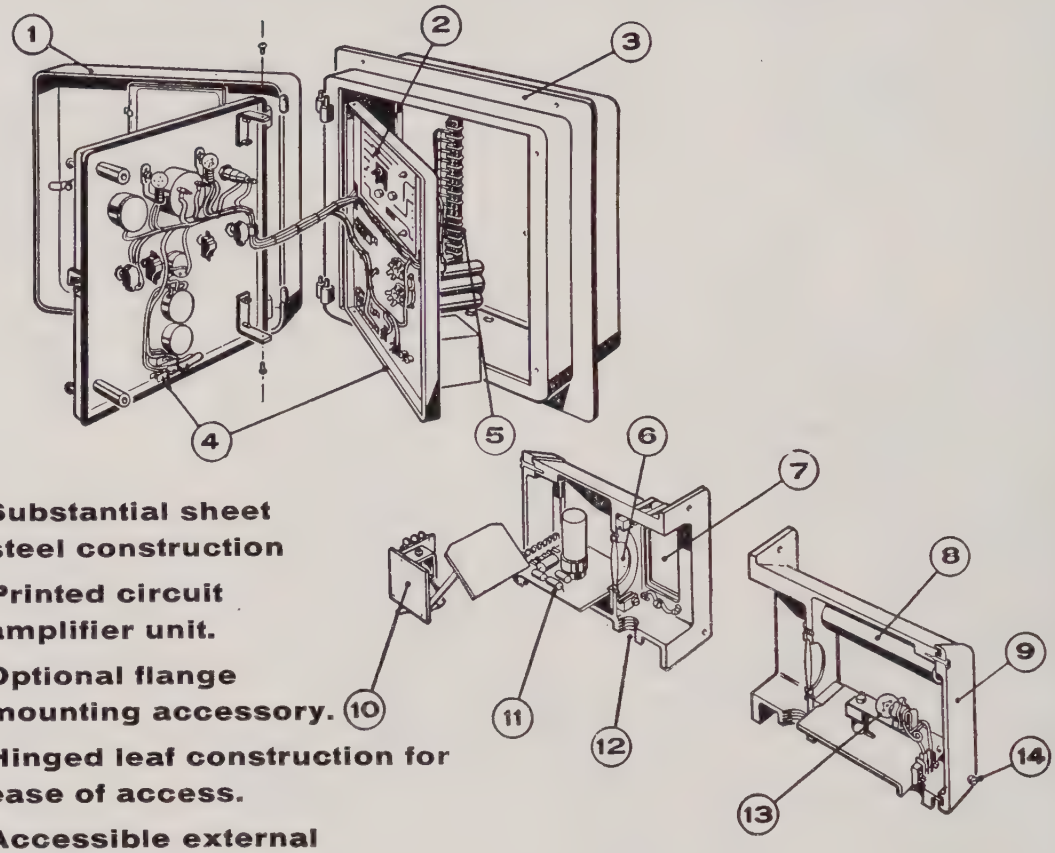


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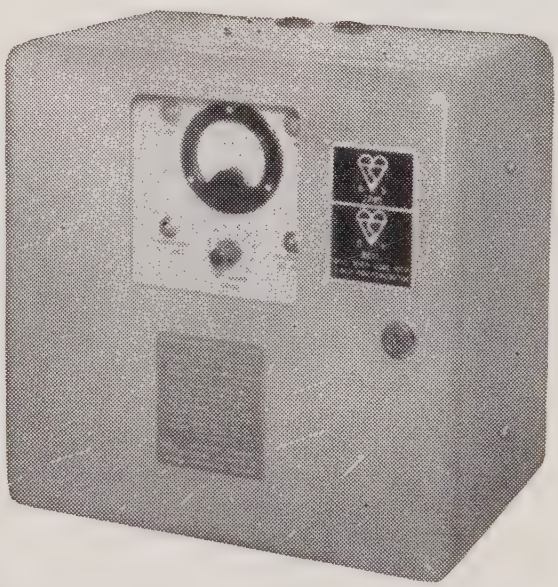
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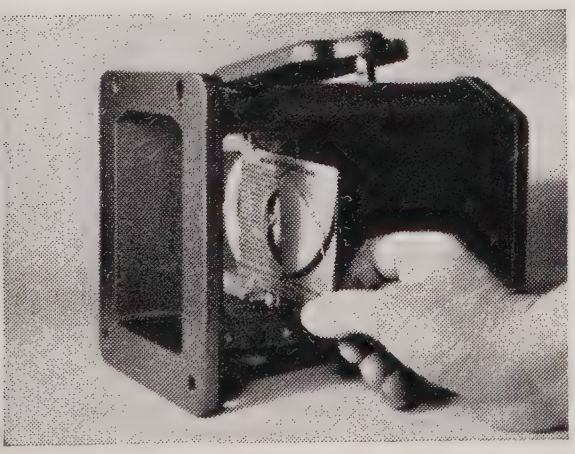
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# S·S·F·F·

# SERVICE

## *to Local Authorities promoting CLEAN AIR*

Local Authorities promoting "Clean Air" campaigns or establishing Smoke Control Areas are invited to enlist the advice and assistance of the Solid Smokeless Fuels Federation. The Federation will organise or participate in Clean Air Campaigns or individual exhibitions under the auspices of the Local Authority. Services of this kind have been provided for Local Authorities up and down the country. The S.S.F.F. exhibition stand and mobile exhibition units are supplied free and have been prominent features of such campaigns.

*S.S.F.F. Exhibition Stand displaying approved solid smokeless fuel appliances under fire and the full range of authorised fuels*



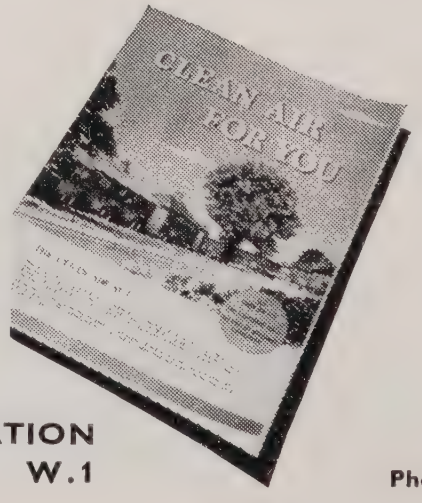



*S.S.F.F. Mobile exhibition unit displaying approved solid smokeless fuel appliances under fire and the full range of authorised fuels*

### LITERATURE AVAILABLE

A RANGE OF LITERATURE IS AVAILABLE FREE TO LOCAL AUTHORITIES

This deals with the Clean Air Act, explaining its provisions and how it must be implemented. There are publications describing modern approved appliances to comply with the Act and how to get the best out of them and on the authorised solid smokeless fuels and their application. For specimens or for further information apply to:




**SOLID SMOKELESS FUELS FEDERATION**
**74 Grosvenor Street, London, W.1**

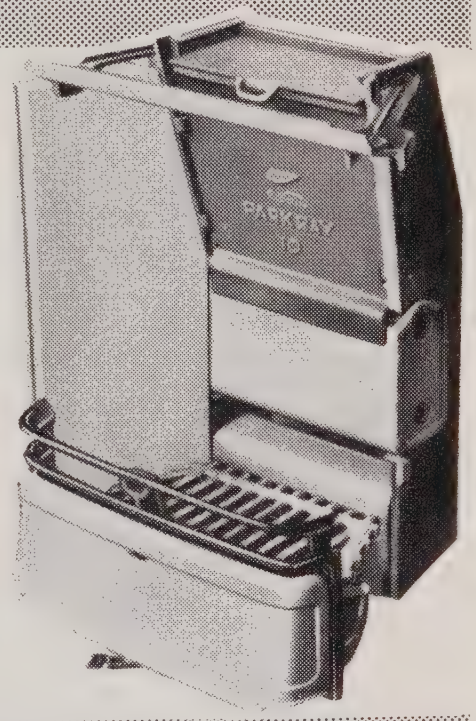
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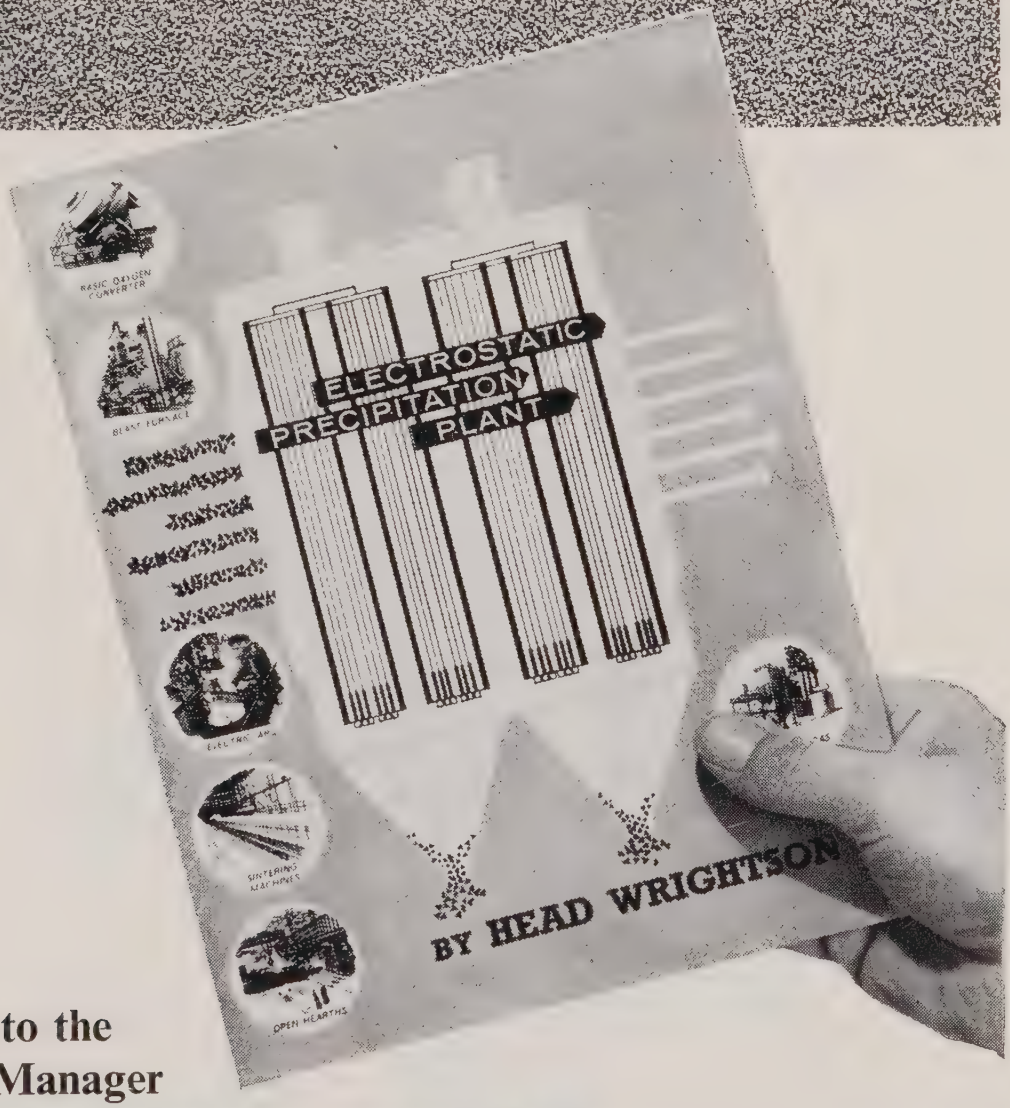

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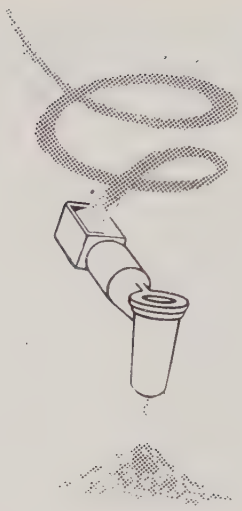

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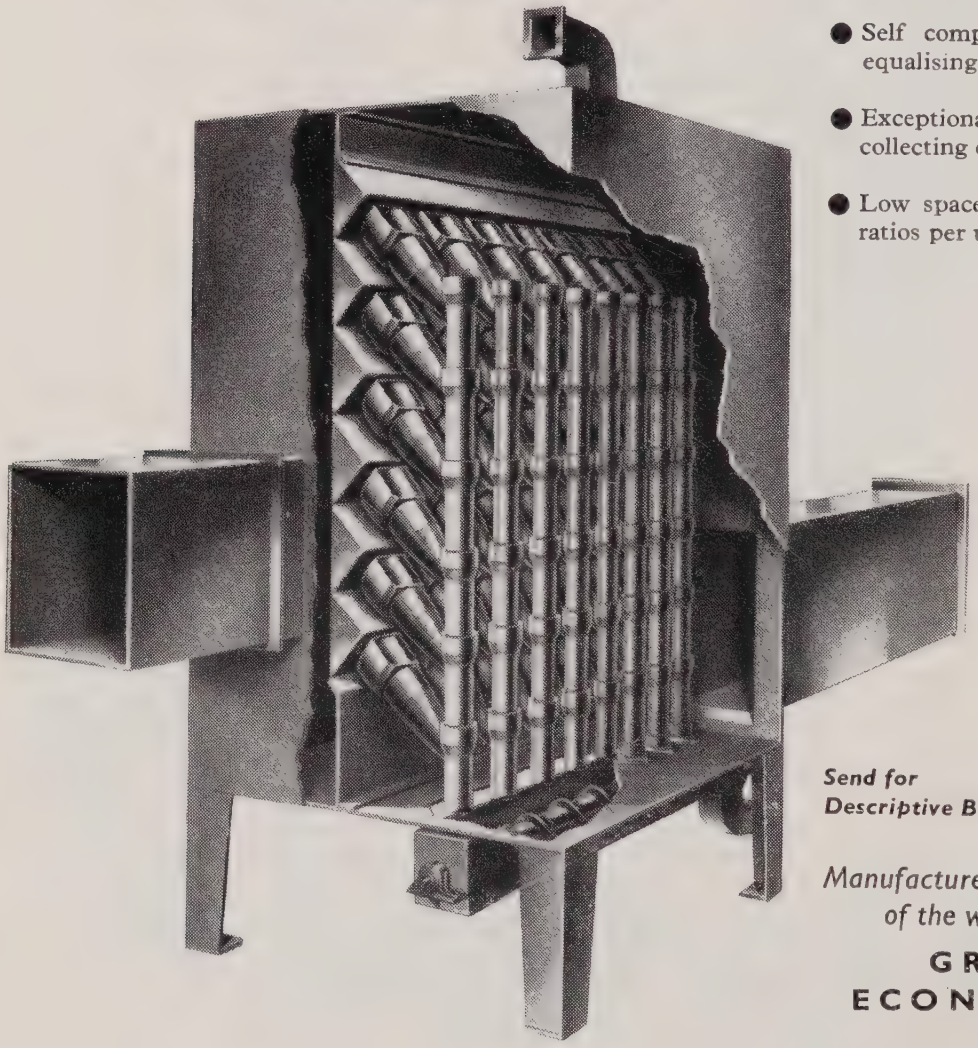
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# SMOKELESS AIR

Vol. XXXI No. 117 Spring 1961

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*Ships, towers, domes, theatres and temples lie*
*Open unto the fields, and to the sky;*
*All bright and glittering in the smokeless air.*

# SMOKELESS AIR

## *The Need for Publicity*

PROGRESS in the establishment of smoke control areas may be said to be fair. It is not as fast as we should like nor as the Beaver Committee hoped for, but it is proceeding. Moreover, the results so far as they go are very satisfactory, both in the benefits that have already been noted and in the general acceptance of the changes by the people in the areas.

But it will not do to be complacent and to expect that progress will continue automatically and without a further need for education and explanation. It has to be remembered that for many individuals the change-over to smokelessness is a big and often unexpected demand, and that the more timid and more conservative may well object. In the majority of cases such objections, if they arise at all, are small in number and can be cleared up by personal contact and explanation. But in some districts objectors have been vociferous, have even been organized, and have been worked on and encouraged by the agents of commercial interests. Reasonable doubts and queries have been fanned into agitations that have led to delays through public inquiries and maybe in some cases have even caused local authorities to hesitate in proceeding with their plans. Such agitation tends, naturally enough, to be given publicity in the local Press and tends to seem to be much bigger and more important than it really is.

This sniping at smoke control is seen and watched by the Society through the Press cuttings it receives and the communications from local authority members asking for information or assistance. The objections raised follow a familiar pattern—complaints about smokeless fuels, their supposed dangers and other drawbacks, the red herring of sulphur, and the demand in the name of liberty to continue to poison one's neighbours' air (although it is not expressed like that). It is necessary to meet these attacks fairly, firmly and promptly, for though they may be negligible in themselves they can become infectious, especially when they are deliberately fostered. The anonymous advertisement reproduced on another page is a particularly shifty attempt to create a public opinion against clean air measures.

The need for more intensive education and publicity were recognized by the Beaver Committee and expenditure for the purpose is expressly authorized by the Clean Air Act. Now, as smoke control areas are beginning to spread throughout the country, the need for more and better publicity is increasingly apparent. Some local authorities give special and continuous attention to the question, but many are not so alert to its importance. Propaganda for clean air should begin long before smoke control orders are proposed, let alone made, and should be patient, persistent and varied. The ordinary man in the street, and his wife in the home, have only the vaguest understanding of the air pollution problem, and of their own contributions towards it. Their enlightenment cannot begin too soon. An outspoken, but all too true, comment on this will be found in the quotation from the report of an M.O.H. on page 190.

In the absence of funds from any source for the big national publicity campaign that is really needed, much of the work has to be done by the local authorities themselves; and they should be prepared to spend much more than they are doing for this purpose. They must accept the fact that publicity, to be effective, cannot be done on the cheap. Display material, exhibitions, printed matter, advertising and other work, must be of good quality and attractiveness if it is to compete for attention with the flood of commercial publicity to which we are all subject. It is often difficult, too, for local authority members and officers to give to this matter the detailed thought and attention (or experience) that it calls for.

The Society is very much aware of the need for more and better education and publicity, and also of the need to rebut the deliberate anti-clean air propaganda that so frequently appears. As our members know, our efforts are irritatingly restricted by our lack of the funds needed to do the job properly.

## *Publicity Advisory Service*

We are, however, able to report two steps forward in our efforts to assist our members. The services that are available to our members in the field of publicity and education are being extended and made more definite and ordered by the setting up of a new Publicity Advisory Service. This, which will be free to all members, is intended, as it takes form, to cover all forms of publicity—display material, exhibitions, printed leaflets and posters, advertising, Press publicity and correspondence, educational activities, and the like. In addition to the services offered individually on request, it is hoped to prepare and issue information and notes of general publicity interest. A first step towards this is the production, very shortly, of an illustrated catalogue of the Society's display material available on loan to members.

A second new publication, also to be available shortly, is a leaflet for quantity distribution dealing entirely with the case against domestic smoke, now recognized as the most serious factor in air pollution in this country. The title will be *Clean Air Begins at Home*. We believe it will be welcomed by all local authorities, and especially by those who are having to counteract propaganda that house smoke is of no importance.

## *Simpler Procedure*

The Ministry of Housing and Local Government in Circular No. 1/61, have informed local authorities of an important simplification of procedure in the setting up of smoke control areas. For authorities in the " black areas " it will no longer be necessary to notify the Minister of their intentions to make orders. Local authorities outside the black areas should, however, continue to notify the Minister of their first smoke control order proposals. This should make things considerably easier for both the local authorities and the Ministry's own staff. It will mean the disappearance of the list of notifications that this journal has each quarter included in its Progress Report on smoke control areas.

The circular emphasizes that it remains of great importance that before making orders local authorities should consult the regional fuel advisory committees about supplies of smokeless fuel. The circular also amends a previous circular (28/60) in respect of classes of authorized fuel. " Certain dry steam coals " become " low volatile steam coals " and the word " certain " should be omitted from the phrase " certain semi-cokes."

## *Goals and Costs*

How the U.S.A. is driving ahead on air pollution control is shown by the " National Goals " report mentioned in our International Section on another page. It is interesting to look at the

proposal to increase research support to $32 million a year, and the sources from which this is to be obtained. It is interesting, even if rather fanciful, to calculate the contributions that would be called for in Britain on a similar basis. Reduced in proportion to population, the total for this country would be £3 millions a year, £1,200,000 coming from the Government, £840,000 from industry, and £960,000 from the local authorities. Such sums could with profit be expended on something very like the American ten goal programme—although we would like to add an eleventh item: publicity and educational work to make the public thoroughly clean air conscious. £3 millions a year might seem like crying for the moon, but it is after all less than one per cent of the national bill for air pollution. The £250 millions a year figure given by the Beaver Committee has recently been said by Sir Hugh himself to be too conservative. In his view the annual cost is nearer to £400 millions.

## *The President*

Under the Society's constitution a President cannot serve for more than two years, and it will be with the warmest appreciation that we shall see Sir Hugh Beaver's term of office come to an end at the Annual General Meeting on March 24th. We are very pleased to be able to announce that Lord Cohen of Birkenhead has honoured the Society by accepting nomination as the new President. The nomination will be placed before the Annual General Meeting for formal approval, there having been no other nomination.

The Society has every reason to be grateful to Lord Cohen for accepting the invitation. As one of our most distinguished and public-spirited medical men, Lord Cohen is a member of many public bodies and committees, both nationally and in his own Merseyside, and his Presidency of the Society will be of the greatest benefit, not only to ourselves, but to the clean air campaign generally. His support will do much to help us to maintain the emphasis, which must never be overlooked, on human health as the foremost reason for the prevention of air pollution.

## *The Chairman*

All members of the Society, and especially those who know him personally, will wish to join us in congratulating our Chairman, Mr. John Innes, on the honour he received at the New Year by appointment as a Member of the Order of the British Empire. Mr. Innes has served the clean air movement with great distinction for many years in Scotland, where he is President of the Society's Division and a member of the official Clean Air Council for Scotland. He has also represented Scotland for many years on the national Executive Council, and is now its Chairman. Although other public services have contributed, we believe that the honour was conferred mainly on account of his leadership for clean air.

## *New Views on Smoke*

One of the Society's most popular leaflets, " Facts about Smoke " (which has been distributed in its thousands) has a tear-off slip for return to the Society, asking for more information. It also asks for the numbered " facts " to be judged in order of importance, and there is a space for any other fact that the sender thinks should be mentioned. Some intriguing facts have been entered on the slips that have come back to us, and recently from the Ipswich area, apparently from schoolboys, came two new points. Though maybe in need of some qualification, they do seem to have something: " Smoke destroys the good looks of the human race," says one, while the other declares that it " affects sportsmen, making them shortwinded and unfit to compete with other smokeless countries."

# *The Certification of Furnace Operators*

## A Proposed Bill—For Discussion

It has for long been recognized that one of the most frequent causes of smoke emission from industrial boiler and other furnaces is a lack of training among the operators. Courses of instruction, and the issue of certificates of proficiency started over half a century ago, and in recent years—for reasons of fuel efficiency as well as smoke prevention—have been considerably developed. There are, however, still very many furnace operators without a qualification, and still very many installations which, to be efficient and smokeless, need a skilled operator.

The Executive Council of the Society considers that the time is now ripe for requiring all appropriate operators to be duly certificated, and that legislation for this purpose should be passed by Parliament. It has therefore drafted, through its Technical and Parliamentary and Local Government Committees, a draft for a Bill, as follows:

The Bill has attempted to meet the objections that have in the past been raised to such proposals, and each clause has received careful consideration. It is now published for the purpose of promoting discussion and criticism. All who may be interested are invited to let the Society have their views. It is hoped that a report on this discussion, and on the reception of the proposal generally, will be possible for consideration at the Brighton Conference in October.

Reprints of the proposed Bill and this note are to be made and copies may be obtained on request.

---

### A BILL FOR THE CERTIFICATION OF FURNACE OPERATORS

#### PREAMBLE

The objects of this Bill are threefold, namely:

(*a*) to secure a minimum standard of competence, obtained by training or by experience, of persons engaged in the duty of firing furnaces consuming fuel from which smoke could be produced;

(*b*) to facilitate the attainment of clean air in accordance with the objects and the provision of the Clean Air Act, 1956; and

(*c*) concomitantly with (*a*) and (*b*) above, to further the attainment of greater efficiency in the use of fuel.

#### THE BILL

1. On and after such dates as shall be prescribed by the Minister, by means of Regulations, it shall be an offence for the occupier of any building or the owner of any plant installed on land to allow any person to perform the firing or other direct operation of any such furnace specified in Schedule A annexed to this Act, unless he possesses either

(*a*) one of the certificates specified in Schedule B annexed to this Act showing that he has received adequate instruction in and practical experience of the operation of fuel consuming furnaces;

or

(*b*) a certificate signed by or on behalf of a local government authority stating that he is known to have had adequate experience over a period of not less than one year in the operation of fuel-consuming furnaces and is proficient in that work.

2. This Act shall not apply to any person undergoing practical training in the firing of furnaces provided that he shall not be permitted to operate the firing of a furnace without adequate supervision.

3. If the occupier of any building or the owner of any plant to which this Act applies is unable to obtain the services of a person qualified in terms of Section 1, he may apply forthwith to the local authority of the area in which the furnace is operated for a certificate temporarily exempting him from the provisions of this Act provided either (*a*) that he can show that he has taken adequate steps to obtain such qualified person, or (*b*) that he has under training a person who has entered on a course of training approved by the institution concerned with candidature for one of the examinations prescribed in Schedule B.

A certificate issued in accordance with this section shall be valid for a period not exceeding three months in the first instance, during which period the occupier of any building or the owner of any plant may not later than one month before the expiry of its validity apply for an extension of its validity for further periods not exceeding in all one year.

4. No certificate issued in accordance with the provisions of Section 1 sub-section (*b*) of this Act shall be issued after five years from the passing of this Act or such later date as the Minister may direct.

5. This Act shall apply to a self-employed owner or user of a furnace engaged in the operation of firing the furnace as it does to any owner or user of a furnace employing another person for the same purpose.

6. Any person aggrieved by the refusal of a local authority to grant a certificate under Section 1 (*b*) or Section 3 may appeal to a court of summary jurisdiction against such refusal within one month of the intimation thereof.

7. The Minister may from time to time by Regulation, amend the list of furnaces in Schedule A as he thinks fit.

8. Any person guilty of an offence under this Act shall be liable on summary conviction to a fine not exceeding £10 in respect of any day on which the offence shall have occurred.

## SCHEDULE A

Stationary boilers of all kinds other than (*a*) those prescribed in para. 33 of the 2nd Schedule of the Clean Air Alkali, etc. Works Order No. 497 of 1958 and Order 1932 (S.105) 1958, (*b*) all fully automatic plants, and (*c*) furnaces rated at 1 million B.T.U. per hour or below.

## SCHEDULE B

*List of certificates of proficiency in the operation of Boiler Furnaces*

Boiler Operators' Certificate and Intermediate Grade, Boiler House Practice Certificate of the City and Guilds of London Institute. Boiler Operators' Certificate of the Scottish Division of the National Society for Clean Air. Such other qualifications as may be approved by the Minister.

---

**B.S. Miniature Smoke Chart**

The British Standards Institution have now prepared and issued a miniature smoke chart. Unlike the miniature Ringelmann chart this consists of a card with five one inch squares of even grey tints, the depth of colour of which correspond with the Ringelmann chart grids. The chart is available from the Institution (2 Park St., W.1) at 3s. each or 24s. per dozen. Instructions for use are included in the Ringelmann Chart booklet, price 2s. 6d. net.

# THE CONTROL OF AIR POLLUTION FROM MOTOR VEHICLES IN THE UNITED STATES

by

**P. J. Harrop**

*Ministry of Housing and Local Government*

*This Paper, written in June 1960, is based on information obtained personally by the author during a visit to the United States of America in 1960. Its publication in this journal has been approved but it is not an official paper. Inquiries about air pollution from motor vehicles in Great Britain should be addressed to the Ministry of Transport. The paper will be the subject of the meeting of the Society to be held on Friday, 24 March 1961, at the Caxton Hall, London, following the Annual General Meeting. It will be introduced by Mr. Harrop, after which there will be a discussion on the paper and motor vehicle pollution generally.*

## SUMMARY

1. In the atmosphere of Los Angeles, where temperature inversions are frequent, hydrocarbons, particularly olefins, and oxides of nitrogen in the presence of strong sunlight take part in a photochemical reaction which produces "smog." This "smog," which is characterized by the presence of oxidants, including ozone, reduces visibility and causes eye irritation and damage to vegetation.

2. The greatest source of hydrocarbons and oxides of nitrogen in Los Angeles is motor vehicles. Other sources of hydrocarbons have been drastically controlled. San Francisco which also has photochemical smog on occasions still gets most hydrocarbon pollution from sources other than cars.

3. It is debatable whether photochemical smog is likely to occur in the majority of the world's cities, whatever the concentration of motor vehicles; strong sunlight and low level inversions rarely occur together in sufficient concentration.

4. This raises the question: should control measures against the discharge of hydrocarbons or oxides of nitrogen from motor vehicles (which otherwise occur below the toxic level) be taken outside California. The American motor industry tends to think not.

5. Carbon monoxide is also discharged from motor vehicles and from other sources. It takes no part in the photochemical reaction, but is a known toxic substance above a certain concentration. There is no agreement in the U.S.A. on whether levels in the atmosphere of busy streets merit concern but California have produced standards for carbon monoxide in the air, and in motor vehicle exhaust gases. Reductions in carbon monoxide from exhausts are to be required in that State.

6. Hydrocarbons can be discharged to air from petrol at filling stations, from petrol tanks and from carburettors. In hot weather these evaporation losses are considerable—in Los Angeles about one-eighth of the total discharged from vehicles. About one-third of hydrocarbons are lost to air through "blow-by"—vapours which pass the piston rings into the crankcase and are discharged on American cars through the crankcase breather.

7. The main discharge of pollutants is from the exhaust pipe: up to two-thirds of the hydrocarbons and all carbon monoxide and oxides of nitrogen escape this way.

8. Much research on control measures has been undertaken.

(*a*) Blow-by losses can be stopped by recirculation of the vapours through the engine. Such devices may cost $10 on a new car. They are to be fitted to all new 1961 models for California.

(*b*) Devices to minimize the formation of exhaust carbon monoxide and hydrocarbons during the deceleration cycle have been developed but are not too successful.

(*c*) Both flame afterburners and catalytic afterburners for consuming exhaust hydrocarbons, and in some cases carbon monoxide, are being developed. Their cost may be $100–150 a unit. Operational efficiency may be a problem for catalytic devices.

(*d*) Engine redesign may offer a long term solution. Pollution can, also, be cut down by proper maintenance to ensure efficient combustion.

(*e*) Evaporation losses from cars would be too costly to prevent by comparison with the trouble they cause. Losses from petrol storage and handling are controlled in Los Angeles (and no doubt elsewhere).

(*f*) The standard methods known for minimizing the formation of oxides of nitrogen during petrol combustion increase petrol consumption considerably, but a new technique involving the partial recirculation of exhaust gas through the engine has been discovered.

9. Various laws controlling emissions from petrol engined vehicles are in force:

(*a*) Los Angeles limit the olefin content of petrol (olefins are the pacemakers in the photochemical reaction).

(*b*) They control hydrocarbon losses from petrol storage tanks and petrol loading installations.

(*c*) California have established standards for ambient air quality, and for hydrocarbon and carbon monoxide exhaust discharge.

(*d*) California have also passed a Bill this year for the control of motor vehicle pollution. The Bill appoints a Control Board charged with the task of approving devices for vehicles which will enable them to comply with State standards. When devices have been approved they will have to be applied progressively to new cars, cars on trade-in, commercial vehicles and existing cars.

10. The emission of excessive smoke from motor vehicles is illegal in most parts of the U.S.A. Enforcement is generally in the hands of the police, or State highway patrols, though air pollution inspectors often have concurrent powers. Cincinnati and Detroit are both vigilant, taking punitive and educational measures. The Governor of California has ordered stricter control of smoke as an accompaniment to the new State legislation dealing with invisible pollutants.

11. There is general agreement about the causes of smoke, which are mostly capable of cure. There seems to be less research on devices to suppress emissions from diesel engines than from petrol engines. Odour from these engines is receiving attention. Buses with engines burning liquid petroleum gas (propane) are used in Chicago; they are efficient, economical and free from obnoxious exhausts.

## REPORT IN FULL

### Invisible Pollutants

#### The role of hydrocarbons and oxides of nitrogen from motor vehicles

12. Under certain meteorological conditions hydrocarbons and oxides of nitrogen in suitable concentration in the atmosphere take part in a photochemical reaction which produces "smog." These conditions frequently prevail in Los Angeles, which suffers from numerous low level temperature inversions (on about 260 days in the year the inversion base is from ground level to 3,000 feet and wind velocities average less than 6 m.p.h.), as well as enjoying strong sunlight. The sunlight is essential to the reaction; so indirectly is the inversion and lack of wind which

prevent the proper dispersion of pollutants in the atmosphere. The pollutants themselves come from a number of sources—the majority from motor vehicles and their fuels. In this Los Angeles is almost certainly unique.

13. The Los Angeles " smog " has been classified by some experts as an " oxidizing " smog. Its particular characteristic is the presence of oxidants, including ozone, in the atmosphere, This type of smog is responsible, among other things, for reduced visibility, damage to plants and vegetation, and eye irritation. The precise agent responsible for eye irritation has not yet been identified. There appears to be no association between air pollution and respiratory deaths in Los Angeles as there is in London. But London air pollution is characterized by the presence of sulphur dioxide and particulate matter in the atmosphere.

14. A reduction in oxidant levels depends on reducing the discharge to the atmosphere of hydrocarbons, particularly olefinic hydrocarbons, and/or oxides of nitrogen. (Recent research indicates that it may also help if sulphur dioxide levels are reduced.)

15. In Los Angeles the discharge of hydrocarbons from sources other than motor vehicles has been drastically cut down. Motor vehicle exhausts are now reckoned to be responsible for about 75 per cent of the daily 2,000 tons hydrocarbon emission; on hot days evaporation losses from carburettors and petrol tanks bring the figure up to nearly 80 per cent. Likewise about 65 per cent of the oxides of nitrogen in Los Angeles come from motor vehicles. The San Francisco Bay area where air pollution control is in its infancy, gets 30 per cent of its hydrocarbons from motor vehicles and 50 per cent of its oxides of nitrogen. Neither city is a coal using city and the amount of fuel oil consumed is relatively not great because of warm temperatures and the extensive use of natural gas for heating. By comparison in Detroit, a coal using city, motor vehicles probably provide no more than 15 per cent of air pollutants in the city's atmosphere.

16. It is debatable whether a photochemical reaction is likely to occur in the air over the vast majority of the world's cities, regardless of the concentration of motor transport.

17. Measurements of ozone—an indicator of oxidant level—in the atmosphere of certain United States cities tend to indicate that it is unlikely. Six cities are known to have measured ozone above 1/10th ppm. Of these, five have recorded levels approaching 0·25 ppm above which eye irritation may occur. Los Angeles have had levels as high as 1 ppm and for long periods of the year have averages of 0·25 ppm. The next highest readings have been in San Francisco (0.6 ppm max. and 0.07 ppm average) Santa Clara and San Diego, all in California. The remaining places are College, Alaska and Charleston, W. Va. Oxidant pollution does not seem to be a problem in cities like Detroit, St. Louis or Cincinnati.

18. Accordingly there are grounds for thinking that oxidant type air pollution is primarily a West Coast, sub-tropical inversion phenomenon likely to be most severe where surrounding high mountains minimize the circulation of air.

19. On the other hand there have been occasional local incidents in the eastern part of the country which would seem to indicate the occurrence of photochemical reactions in the atmosphere.

20. Perhaps the significance of the issue is this; oxides of nitrogen in the atmosphere even in the worst conditions are very much below the toxic level; hydrocarbons from motor vehicles have no demonstrable ill effects *per se*. Both, however, assume a major role in the photochemical reaction. Where that reaction occurs to produce harmful effects, control measures to limit the discharge of either nitrogen oxides and/or hydrocarbons must be taken. Where there is no such reaction, control measures

may not be needed. (See paragraph 32.)

**The role of carbon monoxide from motor vehicles**

21. Carbon monoxide is a known toxic substance for which the maximum allowable concentration for an 8 hour shift in industry is 100 ppm (U.K. and U.S.A.). Concentrations considerably higher have been measured in busy London streets at peak traffic times in poor weather conditions. Maximum levels in Detroit are reported to have been nearly up to 100 ppm for short periods but CO levels average about 10 ppm. The yearly average figure for Los Angeles is about 5 ppm with daily maxima often of 20 ppm. On smoggy days readings may be between 30 and 45 ppm. 100 ppm has never been recorded at any of its measuring stations but figures of that order have been recorded on major traffic routes at times of traffic congestion over extended areas.

22. Some people in America are doubtful whether carbon monoxide on its own constitutes an immediate problem at present levels. Los Angeles say there is no evidence that CO in the atmosphere contributes to eye irritation, vegetation damage or reduced visibility, *i.e.* that it takes part in the photochemical reaction. But there are experts who think that high concentrations at street levels merit concern. Recently the State of California brought out a standard for air quality which indicates 30 ppm for eight hours or 120 ppm for one hour as a serious level of air pollution. (See paragraph 59.)

23. Carbon monoxide is discharged wherever fuel is burnt incompletely and from certain industrial processes. These emissions as well as discharges from motor vehicles have to be taken into account in assessing the general air pollution problem. In Detroit, less than 15 per cent. of the city's total air pollution comes from motor transport. In Los Angeles, on the other hand, following the latest industrial control measures, it is estimated that over 90 per cent. of all carbon monoxide comes from motor vehicles. With the Los Angeles levels in mind, California have translated their standard for carbon monoxide in the air into a further standard for permissible carbon monoxide in vehicle exhaust discharges. (See paragraph 61.)

**Sources of hydrocarbons, oxides of nitrogen monoxide from motor vehicles**

24. Carbon monoxides and oxides of nitrogen are produced by the incomplete combustion of petrol (and of other motor fuels). They escape to atmosphere mainly through the exhaust pipe. Hydrocarbons may escape not only in the exhaust gases, but also before combustion by evaporation losses and through what is called " blow-by ".

25. In hot weather, *i.e.* above 75°F. and especially over 100°F., losses of hydrocarbons by evaporation at filling stations, from petrol tanks and from carburettors may be considerable. In Los Angeles about one-tenth of all hydrocarbons escape to air by this route in the hottest periods.

26. Recent research by the American motor industry has shown that " blow-by " is another route for substantial losses of hydrocarbons to atmosphere. " Blow-by " is the name given to the escape of vapours, mainly unburnt petrol gas/air mixture with some combustion products, past the piston rings down the side of the cylinders to the crankcase. In American cars these vapours are then piped to air through the crankcase breather. Between 30 and 40 per cent. of the total discharge of hydrocarbons from motor vehicles may escape to air this way, according to the motor industry. The Taft Sanitary Engineering Centre of the U.S. Public Health Service are conducting an independent check on this result as part of their research work on the components of motor vehicle exhausts. Their preliminary figures confirm that blow-by emission is considerable.

27. One feature of blow-by is that hydrocarbons which get out this way are likely to correspond closely with those present in the petrol. If the petrol is low in olefinic hydrocarbons then the blow-by losses will be low in olefins. Hydrocarbons emitted in the exhaust gases on the other hand are partly products of combustion and because of chemical changes during combustion could easily be much richer in olefins than the petrol itself. Blow-by hydrocarbons may contain as little as 12 per cent. olefins depending on petrol composition whereas exhaust hydrocarbons may contain 45 per cent. olefins. The importance of olefins in the photochemical reaction is that these hydrocarbons appear to set the pace in stimulating the reaction.

28. The main emission of pollutants is from the exhaust pipe which carries away the products of combustion and some unburnt gases. These include hydrocarbons, carbon monoxide and oxides of nitrogen. Much analytical work has been carried out by the motor industry and by research laboratories; and the U.S. Bureau of Mines have for some time been engaged on behalf of the U.S. Public Health Service in a study of the characteristics of exhaust gases in varying conditions of engine operation using different gasolines.

**Methods of Control**

29. Many engineering and chemical companies have spent heavily on research into ways of reducing air pollution from motor vehicle exhausts. The motor industry reports that it has spent about $5,000,000 on such research. Los Angeles Air Pollution Control District have reviewed over 1,500 inventions and ideas and have tested 200 in their laboratory. A very few have shown real promise and are being developed intensively now by their inventors. There are units for blow-by control and deceleration devices. Several afterburners appear to be nearing the production stage.

**Control of hydrocarbons and carbon monoxide**

*Blow-by*

30. Blow-by hydrocarbons discharged to atmosphere from the crankcase breather can be recirculated to the engine for combustion. This operation does not increase the amount of hydrocarbons coming from the exhaust pipe.

31. There are two methods of recirculation:

(i) the vapours may be reintroduced *above* the carburettor, *e.g.* into the air filter; or

(ii) they can be introduced *below* the carburettor, *e.g.* into the intake manifold.

The first method is used in some American marine engines and on some non-American cars (including some British cars). For various reasons the American motor industry believes the second method gives better control and they propose to introduce a device of this sort on 1961 models for sale in California. The cost will be about $10 a car. The cost of fitting the device to an existing car might be $15 or $20.

32. The decision of the motor industry to limit the fitting of the device to Californian new cars brought the representatives of the Automobile Manufacturers Association of America under fire in Congress. The general feeling was that all new cars should be fitted so that people everywhere might enjoy the benefits. The Secretary of the Department of Health, Education and Welfare also took this line. The attitude of the motor industry is that people should not be asked to pay for a device unless there is a clear need for it. Outside California, the A.M.A. believe there is no such need, since hydrocarbons create an air pollution problem only where a photochemical reaction takes place. (See paragraph 20.) However, motor manufacturers would be willing to fit the device to order for delivery anywhere.

**Deceleration devices**

33. It has been shown that more hydrocarbons and carbon monoxide are produced and discharged from the exhaust pipe when the engine is slowing down that at any other time. A higher than normal vacuum builds up in the intake manifold. Petrol from the carburettor is drawn through but is not efficiently burned. This results in a high discharge of carbon monoxide and hydrocarbons.

34. It is possible to reduce the level of carbon monoxide and hydrocarbons at this stage either (*a*) by opening the throttle slightly on deceleration or (*b*) by shutting off the fuel completely. There are at least two types of device for achieving (*a*); the trouble is that in reducing the manifold vacuum they reduce the compression braking power of the engine, thus leading to excessive brake wear. Devices of type (*b*) tend to affect driving by causing engine stalling or surges of power.

35. Relatively inexpensive deceleration devices were, however, fitted on test cars in America in 1957. The American motor industry claimed that hydrocarbon emissions from the exhaust were reduced by 15 to 20 per cent.

**Flame afterburners**

36. Flame afterburners burn exhaust gases (without the aid of a catalyst) and reduce hydrocarbons and carbon monoxide discharge from the tail pipe. A few models are being developed. Perhaps the best known is the one produced by Thompson Ramo Wooldridge, Inc. in conjunction with the Chrysler Corporation. This unit fits on to the exhaust manifold. Exhaust gases plus air supplied by an air pump (blow-by gases in the latest device) pass through a heat exchanger. This enables combustion to take place during normal running without recourse to a very much richer petrol mixture. The unit works at high temperature, about 1,400°F., and must, therefore, be made of stainless steel. Combustion is triggered off by spark ignition. The resultant gases, which are mainly carbon dioxide and water vapour, pass again through the heat exchanger, this time imparting heat, and are discharged from the tail-pipe. The unit acts as a silencer.

37. There are still a number of problems to be overcome but it is thought that about 90 per cent. of the exhaust carbon monoxide and hydrocarbons should be destroyed.

38. The total cost of the unit might be between $100 and $150—*e.g.* 5 per cent. of the price of a new car. Its probable life should be well over 25,000 miles, subject to periodic inspection and maintenance of the controls and air pump. *

**Catalytic afterburners**

39. Catalytic afterburners are of two main varieties—low temperature (450-750°F.) and high temperature devices (around 1,000°F.). All are designed to reduce hydrocarbons in the exhaust gases; some in each category will attack carbon monoxide. The principle is to burn the exhaust gases with secondary air in the presence of a suitable catalyst in a unit which normally would replace the silencer.

40. Many catalysts have been examined and tried by industry. Some have been more successful than others. The U.S. Bureau of Mines are at present engaged on behalf of the U.S. Public Health Service in a study of materials suitable as catalytic agents and of the principles of catalytic action.

41. The motor industry's research was first concentrated on a low temperature unit. For instance, one was designed using vanadium pentoxide. The prototype, which was fitted to a test car, eliminated about 50 per cent. of the hydrocarbons, including 70 per cent. of the olefinic hydrocarbons. These rather low figures

* There is a Report on Clayton afterburners fitted to some Los Angeles Transit Lines gasoline buses. These flame afterburners had run 19,000–35,000 miles without failure. A few of the units have attained 75,000 miles.

make allowance for the several minutes of engine operation before the catalyst warms to the right temperature. It does not attack carbon monoxide to any great extent, however, and the adoption by California of limits on carbon monoxide rather nullifies its development. The unit was thought to have a life of 10,000/12,000 miles before the catalyst would have needed to be replaced (cost perhaps $25). Arrangements might have been necessary for by-passing high temperature exhaust gases created under extreme heavy duty, for these would damage the catalyst.

42. With high temperature units stainless steel is generally necessary and this adds to the capital cost. The Houdry Catalytic Unit developed by the Oxy-Catalyst Corporation is a high temperature unit employing a non-metallic catalyst. Exhaust gases are mixed with additional air supplied by an aspirator at the entrance to the unit and pass through a hot catalytic bed where oxidation takes place. The ratio of air and exhaust gases has to be regulated carefully to maintain correct temperature for the reaction. This is not easy with a motor vehicle where flows of exhaust gas vary. It is claimed that the unit is 80 per cent. efficient after 10,000 miles, but replacement of the catalyst is still thought likely to be required around 12,000 miles. A prototype is expected to be ready for testing this year.

43. Catalytic devices may be of the same order of cost as flame afterburners ($100-150)—but catalytic devices to deal with hydrocarbons alone might be cheaper.

**Engine design**

44. The motor industry continue as part of normal engine development work to seek improved combustion. This would have the effect of reducing the emission of pollutants in the exhaust.

**Maintenance**

45. Efficient fuel combustion, which minimizes hydrocarbon and carbon monoxide discharge requires routine maintenance of electrical parts—points, sparking plugs, condensers, and of carburettors. In a city, such as Cincinnati, which has "Safety Lanes" for the annual inspection of cars (and cold weather starting problems) engines are likely to be kept in good condition.

46. In California good weather allows sub-standard engines to function. Also there are more old cars. It is possible that good maintenance of all cars could substantially reduce hydrocarbon emissions from vehicle exhausts.

**Evaporation losses**

47. Evaporation, involving hydrocarbon loss to air, may occur from car petrol tanks, and carburettors. It would cost several hundred dollars to deal with this thoroughly, since it would be necessary to seal and pressurize the fuel system and cool artificially the carburettor to allow internal venting—a big cost for a small part of the problem. Alternatively, the volatility of petrol can be reduced so that it does not evaporate so fast.

48. Evaporation losses also occur wherever petrol is stored or handled unless control measures are taken. Those in force in Los Angeles are mentioned in paragraph 55 and 56.

**Control of oxides of nitrogen**

49. Oxides of nitrogen at their present levels in the atmosphere are not generally considered harmful. The need for control arises only where they participate in a photochemical reaction and in that case the motor industry prefer to tackle the other principal agent, hydrocarbons. There are known but awkward methods of reducing oxides of nitrogen in the exhaust gases. These require changes in the carburettor settings to give a richer mixture and a change in spark timing. The maximum reduction in oxides of nitrogen, which would cut emissions from vehicles in Los Angeles to about one-tenth of present levels

would increase petrol consumption and would reduce miles per gallon by 25 per cent. In cash terms this is about $50 a year for 12,000 miles running. The adoption of these techniques, together with the use of an afterburner for the hydrocarbons would jointly cut discharges of oxides of nitrogen and hydrocarbons by 90 per cent.

50. Los Angeles A.P.C.D. reported in March this year that they and the University of California (L.A.) Engineering Department had discovered independently another technique for cutting down the formation of oxides of nitrogen. Reductions of 80 to 90 per cent. have been obtained by introducing, after cooling, some 15 to 18 per cent. by volume of the exhaust gases into the intake system of the engine. The University device consists of a narrow tube to carry the exhaust gas from the tail pipe to carburettor, together with a valve to control the flow. It is estimated to cost less than $15; it has been in operation five months. No uncorrectable loss of power had been found and there was no increase of hydrocarbons in the exhaust gases. The theory of the process is not yet established. It may be that the exhaust gas dilutes the oxygen content of the air thus lowering the flame temperature. Discussions are to be held with the motor industry to initiate final development and supply of recirculation devices.

**Legislation relating to invisible pollutants from motor vehicles**

*Control of olefin content of gasoline in Los Angeles*

51. Preliminary research by Los Angles A.P.C.D. indicated that olefinic hydrocarbons in particular tend to be the pacemakers in the photochemical reaction. Los Angeles have, therefore, passed a law—Rule 63—which will operate from June 30th, 1960, making it an offence to sell or supply for use in the district gasoline having a degree of unsaturation greater than that indicated by a Bromine Number of 30 as determined by A.S.T.M. method. From December 31st, 1961, the standard is tightened to Bromine Number 20.

52. This law is expected to improve the quality of emissions by way of crankcase loss (blow-by), evaporation losses (carburettors and petrol tanks) as well as securing some improvement in exhaust emissions. It is regarded as an interim measure since it substitutes one pollutant for another, *i.e.* one type of hydrocarbon for another, but it should cut down the photochemical reaction. Petrol of low olefin content requires further refining and on that account might be a cent a gallon dearer.

53. To help law enforcement the A.P.C.D. have begun to produce a monthly report on their tests of gasoline sold in Los Angeles to show which fuels are less than Bromine Number 30.

54. A co-ordinated study of fuel—exhaust relationship has been organized by the U.S. Public Health Service at the request of Los Angeles. The exhaust products from gasolines of a wide range of compositions are being analysed. A number of organizations are taking part, including the U.S. Bureau of Mines, the refining industry and the motor industry. The result so far is said to be in general conformity with the Los Angeles findings, which led to the adoption of Rule 63. Some people are a little cautious about olefin control, however. They point out that olefin exhaust emissions may be substantially due to chemical changes taking place in paraffinic hydrocarbons during combustion.

*Control of hydrocarbon emissions in Los Angeles from storage of petroleum products and gasoline loading into tank trucks and trailers*

55. Los Angeles A.P.C.D. Rule 56 requires petrol storage tanks either to be pressurized to prevent hydrocarbon vapour or gas losses to the atmosphere or to be equipped with vapour loss control devices, such as floating roofs or vapour recovery and disposal systems.

56. Rule 61 requires large loading installations (loading more than 20,000 gallons of gasoline a day) to be fitted with a vapour collection and disposal system or its equivalent.

**Recent legislation by the State of California**

*Standards for ambient air quality and motor vehicle exhaust*

57. In 1959 the State Legislature passed two laws. The first, 426.1, required the State Department of Health, by February 1st, 1960, to work out standards for the quality of the air of the State in relation to the intensity and composition of air pollution and the health, illness, including irritation to the senses, and death of human beings as well as damage to vegetation and interference with visibility.

58. The second law, 426.5, required the determination of maximum allowable standards of exhaust contaminants from motor vehicles, which are compatible with public health, including irritation to the senses.

59. The air quality standards were devised first. The Department of Health aiming at reasonable standards which would be constitutionally valid, took into account the effect of pollutants on groups of people most sensitive to air pollution because of age or medical status. Since the effects of air pollution may vary in nature and seriousness, a graded set of standards at three levels—" adverse," " serious " and " emergency " were attempted. The air quality standards are given in full with notes in the Appendix. The important standards are:

60. The Department of Health worked with an advisory committee and technical panels; individual experts and the U.S. Public Health Service were called on to assist. The literature on the medical effects of air pollution was extensively examined, along with records on sickness and health. The difficulties in setting standards for individual pollutants in the oxidant range proved insuperable so that they resorted to an oxidant index. Standards for some important pollutants, including sulphuric acid, ozone, nitrogen dioxide and lead could not be determined for lack of knowledge; work on these goes on.

61. The motor vehicle exhaust standards for hydrocarbons and carbon monoxide were worked out in the light of these air quality standards. They are:

Hydrocarbons—275 ppm by volume as hexane; and

Carbon Monoxide—1·5 per cent. by volume.

The appropriate measuring techniques are prescribed.

62. These exhaust standards are intended to bring air conditions in Los Angeles up to the level of the State standards for ambient air quality. Los Angelse was chosen because its pollution is the worst in the State and because it has the most extensive measurements and records of air pollution on which to work. By adopting its air conditions as a basis for calculation it has also been possible to keep to one exhaust standard within the State.

63. The calculation of the standard took account not only of existing air conditions, but of likely conditions in

| | *"Adverse" Level* | *"Serious" Level* | *"Emergency" Level* |
|---|---|---|---|
| Oxidants | "Oxidant index' 0·15 ppm | — | — |
| $SO_2$ | 1 ppm for 1 hour or 0·3 ppm for 8 hours | 5 ppm for 1 hour | 10 ppm for 1 hour |
| CO | — | 30 ppm for 8 hours or 120 ppm for 1 hour | — |

1970. Estimates were made of the number of vehicles expected to be in use in Los Angeles in that year. Probable changes in the discharge of carbon monoxide and hydrocarbons from other sources were allowed for. As a result of the study, it was decided that a reduction of 80 per cent. in exhaust hydrocarbon and 60 per cent. in exhaust carbon monoxide emissions would be necessary in Los Angeles. The two vehicle exhaust standards are designed to secure these reductions.

64. There is no standard for blow-by emission. One may be needed. If a standard is worked out which requires the reduction or elimination of blow-by it may have repercussions on the exhaust standard. This will depend on whether the blow-by vapours are introduced into the engines or whether they are led directly into the afterburner without prior combustion.

65. Probably no one is wholly satisfied with the two sets of standards which have been evolved and now approved by the State but it is generally accepted that performance standards such as those for vehicle exhausts at least give a target to engineers working on control devices.

*California Bill to control motor vehicle pollution, 1960*

66. Following the adoption of the two sets of standards, the California Legislature approved, in April 1960, a Bill to control pollutants from motor vehicles. The new law sets up a Motor Vehicle Pollution Control Board appointed by the Governor, with the task of determining standards for pollution control devices and issuing certificates of approval. One year after the date on which the Board have issued a certificate for two or more devices, any new vehicle, or any used vehicle on change of ownership, must be equipped with an approved device. Broadly speaking, all used commercial vehicles must be fitted within two years, and all vehicles within three years, of the original certification date. (These requirements are linked to the registration of vehicles on December 31st in any year). Commercial vehicles have been made a special class because they may need special devices and because they run more miles each year. In addition, the Board has power to exempt special classes of motor vehicles including those for which approved devices are not available or those which meet the State standards without additional equipment. This latter exception might cover diesel engined vehicles which have a low carbon monoxide and hydrocarbon emission.

67. Counties with no air pollution problem by reference to the State air quality standards are exempt from the law subject to a two yearly review. Vehicles whose principal location is within an excepted county need not be fitted with devices.

68. Los Angeles A.P.C.D. pressed strongly for a State law, because vehicles move around and are not solely a local problem. County exception vitiates the principle of statewide treatment to some extent, but the belief is that exception will extend mainly to rural counties, and that it will have to be reviewed if it does not work.

69. The Bill is designed for the control of hydrocarbons and carbon monoxide but, if additional exhaust standards are determined by the State of California, the Bill will extend to the additional contaminants without need of amendment. It is based on the assumption that control devices are at hand and that applications for testing may be expected when the Board are ready. The Board are likely to hold public hearings at which evidence about performance and production prospects will be heard. Tests of devices are to be conducted by a new Motor Vehicle Pollution Control Laboratory. In considering approval of devices the Board have to take account of cost, durability and ease of inspection.

70. The cost of equipping all vehicles in California with afterburners at a price of $100 to $150 per unit would be upwards of

$700,000,000. In Los Angeles the cost would be upwards of $300,000,000 which is perhaps five times what has been spent already on air pollution control. On the other hand, the production of devices in quantity may be much cheaper than present estimates made by the motor industry.

71. In 1961 the Board have to make recommendations about the legislation and other action necessary to implement and enforce the law. Consideration of these matters was deferred by the Legislature who wished to see what devices were approved, since this may well determine the enforcement system.

72. The fitting of devices is likely to be enforced as part of the annual procedure for the registration of vehicles. It is not expected to present difficulty. However, there is general agreement that the operational inspection of some devices to ensure efficient working may be a tough problem. Catalytic units might be more difficult to judge than flame afterburners. Garages undertaking regular inspection would need robust testing appliances. At present this apparatus is designed for laboratory use. A large number of stations would be needed to check California's 7,000,000 car population, which is growing fast. On the other hand, random sampling may be sufficient.

73. The possibility of instrumentation to record the working of devices is said to be worth examination. Catalytic devices would be difficult to instrument but it may be possible to relay information about operating temperatures which could be helpful.

## Smoke from Motor Vehicles

*Law*

74. In most parts of the United States the law forbids the emission of excessive or unreasonable smoke from vehicles. For example, Detroit sets limits to the amount of smoke which can be tolerated from motor vehicles travelling on city thoroughfares. This law resulted from joint discussions with the Automobile Manufacturers Association, Detroit Police Department and the Bureau of Air Pollution. To quote another instance, Cincinnati Ordinance 275 of 1956 prohibits:

(1) unreasonable, excessive or unnecessary smoke, obnoxious or noxious gases or vapours;

(2) operation of bus or truck engine when stationary for more than three minutes except for repair or safe operation or when the temperature is below freezing.

*Enforcement*

75. Enforcement is generally in the hands of the police, or State highway patrols. Air Pollution Inspectors often have concurrent police powers. In some cities the police are very active. Detroit police issued over 3,000 summonses in 1959, and it is reported that lawbreakers were 2:1 private as against commercial. Such figures indicate that smoke from cars can be something of a problem.

76. A number of states and cities require annual vehicle inspection and this is a useful means of checking engine efficiency and smoke tendencies. Cincinnati make a practice of citing offenders to the " Safety Lanes " for examination to make sure that remedies have been taken after an offence. During 1959, about 27,000 cars a month were inspected of which 9,000 cars were rejected for various defects: 450 on account of exhaust trouble, though mostly for defective pipes, rather than excessive smoke.

77. In New York, smoke from diesel engined buses is said to be much less than it used to be (it is no more obtrusive than in London). Any bus observed making unreasonable smoke is by agreement taken out of service at the end of its route.

78. In California complaint about diesel smoke is said to be not uncommon. The discharge of smoke is an offence under the Motor Vehicle Code

and also under the Health and Safety Code (which has heavier fines). In February 1960 the Governor ordered a stricter control of smoke by the State highway police, as an accompaniment to the launching of legislation to control invisible pollutants.

79. Detroit has in the last few years taken vigorous steps to cut down motor vehicle smoke. In 1956/57 a public education campaign was carried on by the Detroit Police Department. During this period a coloured vehicle smoke emission guide was produced jointly by the A.M.A., Detroit Police and Bureau of Air Pollution Control. A technicolor educational film was also produced. A comprehensive training programme on vehicle smoke was organized by the Detroit Police Academy, with instruction on how to use the smoke emission guide. Most police officers went through this training. Subsequently, police efforts have been primarily punitive rather than educational. The Air Pollution Bureau for their part have concentrated on commercial operators—where the persuasive educational approach can be more effective. For instance, these owners have been asked to add a section on smoke to their daily check list of defects. The driver can then report smoke emission and have the engine overhauled. Operators have been asked to institute preventive maintenance programmes. Frequently the initial approach is made after an offence has been observed and a violation notice issued. Court action is rarely necessary by the Bureau's Inspectors. All these measures are said to have wrought a big improvement in the last three years.

80. Few people think that smoking exhausts do harm, but they consider them objectionable and a nuisance; the public are entitled to protection. There is general agreement that smoke is due to poor maintenance, faulty operation and sometimes to use of high distillation fuel in diesel engines. These causes in the main can be dealt with. The overloading of engines was stressed as another cause, and one control officer thought that sometimes this was due to gear sets which were not correctly matched to engines. It was generally agreed that two cycle diesel engines, fitted extensively to buses, were much easier to regulate for smoke than four cycle diesels fitted to large trucks.

81. Much less research work seems to have been done on devices to suppress emissions from diesel engines than on petrol engine devices. Emissions from a well maintained diesel engine are lighter in carbon monoxide and hydrocarbons than from a petrol engine. Not only is the air pollution problem less serious on this account but satisfactory afterburning of leaner gases may be more difficult to achieve.

*Odour*

82. In some cities, chemicals are added to the fuel of diesel buses, to mask the characteristic diesel smell. Philadelpha, on the other hand, has equipped about 100 out of a 1,000 buses with a chamber in the exhaust system in which exhaust gases are mixed with masking agents.

*Propane Engines*

83. Some cities have been trying buses with liquid petroleum gas (propane) engines. These are said to be efficient and free from obnoxious exhausts. Chicago Transit Authority had found the economics of operation about equal to diesel engines, with less need for maintenance.

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The author wishes to record his thanks and indebtedness to the many people in the United States who so readily provided the information about, and so willingly discussed the problems of, motor vehicle exhausts. They include officers of the following organizations:

The U.S. Public Health Service, the U.S. Bureau of Mines; the aid pollution control agencies of the States of California, the Bay area (San Francisco), Cincinnati, Detroit, Los Angeles, New York and St. Louis; the Automobile Manufacturers' Association; and the U.K. Scientific Mission in Washington.

# APPENDIX

## STATE OF CALIFORNIA

## STANDARDS FOR AMBIENT AIR QUALITY

Standards are based on and supported by available, reliable data. In developing the standards, the Department of Health has obtained the advice of scientists with recognized competence in their fields. These standards shall be evaluated, refined, modified, or expanded from time to time as reliable scientific data permit.

The Department will interpret these standards to those agencies responsible for air pollution control. In interpreting these standards, the sites and conditions of air sampling should be so chosen as to realistically represent the exposures of persons and property which might be affected.

Two time periods have been considered: a time-weighted hourly average and an average for an eight-hour period. Concentrations and time periods given in the table refer only to levels for which data are felt to be reliable and suitable for application without excessive assumptions. The footnotes to the table indicate the substances which are being actively evaluated, but which need some additional

## TABLE OF

## STANDARDS FOR AMBIENT AIR QUALITY

| | **"Adverse" Level** Level at which there will be sensory irritation, damage to vegetation, reduction in visibility or similar effects. | **"Serious" Level** Level at which there will be alteration of bodily function or which is likely to lead to chronic disease. | **"Emergency" Level** Level at which it is likely that acute sickness or death in sensitive groups of persons will occur. |
|---|---|---|---|
| Oxidant | "Oxidant index" 0·15 ppm for one hour by the potassium iodide method (eye irritation, plant damage and visibility reduction) | Not applicable | Not applicable |
| Ozone | | Note 1 | Note 2 |
| Nitrogen Dioxide | | Note 3 | Note 3 |
| Hydrocarbons | | Note 4 | Note 4 |
| Photochemicals Aerosols | | Not applicable | Not applicable |
| Carcinogens | Not applicable | Note 5 | Not applicable |
| Sulphur Dioxide | 1 ppm for 1 hour or 0·3 ppm for 8 hours (plant damage) | 5 ppm for 1 hour (bronchoconstriction in human subjects) | 10 ppm for 1 hour (severe distress in human subjects) |
| Sulphuric Acid | Note 6 | Note 6 | Note 7 |
| Carbon Monoxide | Not applicable | 30 ppm for 8 hours or 120 ppm for 1 hour (interference with oxygen transport by blood) | Note 8 |
| Lead | Not applicable | Note 9 | Note 9 |
| Ethylene | Note 10 | Not applicable | Not applicable |
| Particulates | Sufficient to reduce visibility to less than 3 miles when relative humidity is less than 70 per cent. | Not applicable | Not applicable |

data before they can be entered in the table of standards.

The entry, " Not Applicable," indicates that under conditions of community air pollution it is extremely unlikely that the defined effects occur.

It is the intent of the Department to adopt standards for additional substances in the future.

The values entered here are determined on a substantially different basis than the industrial exposure standards. These values are, therefore, not appropriate for application in industrial hygiene.

The bases upon which standards are set are indicated by items enclosed with parentheses.

## NOTES

1. Ozone, at 1 ppm for eight hours daily for about a year, has produced bronchiolitis and fibrositis in rodents (Stockinger, H. E., Wagner, W. D., and Dobrogorski, O. J. A.M.A. Archives of Industrial Health, 16:514, 1957). Extrapolation of this data to man is difficult. Functional impairment data have been reported by Clamann and Bancroft (Clamann, H. G., and Bancroft, R. W. Advances in Chemistry. No. 21, pp. 352–359, 1959); at 1.25 ppm some effect is observed on residual volume and diffusing capacity. The variability of the tests was not reported. Additional data would be needed before a standards is set.
2. A value of 2 ppm of ozone for one hour may produce serious interference with function in healthy persons, and the assumption is made that this might cause acute illness in sensitive persons. (Clamann, H. G. op. cit.).
3. Five ppm of nitrogen dioxide for eight hours will produce decreased pulmonary function in animals. Slightly more may produce pulmonary fibrosis (Stockinger, personal communication); nitrogen dioxide from air pollution exposures is usually combined with nitric oxide and ozone. More data on human exposures will be needed prior to setting a standard.
4. Hydrocarbons are a group of substances most of which, normally, are toxic only at concentrations in the order of several hundred parts per million. However, a number of hydrocarbons can react photochemically at very low concentrations to produce irritating and toxic substances. Because of the large number of hydrocarbons involved; the complexity of the photochemical reactions, and the reactivity of other compounds such as nitrogen dioxide and ozone, it is not yet possible to establish " serious " and " emergency " levels for hydrocarbons. From the public health standpoint, the concentration of those hydrocarbons which react photochemically should be maintained at or below the level associated with the oxidant index defined in the " adverse " standard.
5. Carcinogens include a few organic compounds such as some polycyclic hydrocarbons, and some metals such as arsenic and chromium. Studies on effects of such substances are currently under way, but there is not sufficient data, at present, to set standards. In the meantime, it is recommended that concentrations of carcinogens in air should be kept as low as possible.
6. A sulphuric acid mist level of 1 mg/$M^3$ with an average particle size of one micron will produce a respiratory response in man. (Andur, M. O., Silverman, L., and Drinker, P. Archives of Industrial Hygiene and Occupational Medicine. 6:305, 1952). It is not possible to generalize from this for all air pollution conditions, because under natural conditions particle size will vary. Only with large droplets would sensory irritation be produced without other physiological effects.
7. A level of 5 mg/$M^3$ of sulphuric acid mist for a few minutes produces coughing and irritation in normal individuals (Amdur, M. O., Silverman, L., and Drinker, P. op. cit.). Presumably, it could cause acute illness in sensitive groups of persons in a period of one hour.
8. Given certain assumptions concerning ventilatory rates, acute sickness might result from a carbon monoxide level of 240 ppm for one hour in sensitive groups because of inactivation of ten per cent of the body's hemoglobin. In any event it is clear that when a population exposure limit has been set for carbon monoxide, because of exposures from other sources, community air pollution standards should be based on some fraction of this limit.

9. It is clear that lead levels should be set on the basis of average values for long periods. While data are abundant concerning human response to eight-hours-a-day, five-days-a-week exposures, data are insufficient for the effects of continuous exposure inherent in community air pollution. While laboratory studies will be pursued with vigour, it becomes very important that local agencies collect data on existing lead levels. Since lead exposures are from multiple sources, community air pollution standards should be based on a portion of the total limit for population exposure.
10. Ethylene causes severe damage to vegetation. Ornamental plants are severely injured by exposures from 0·2 to 0·5 ppm. Tomatoes and fruit are adversely affected at similar levels. Current work is expected to permit a standard to be set within a year.

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*A few of the 70 members of the North-West Division of the Society during a recent visit to the Denton works of the North Board. After a tour of this modern works and a buffet lunch, the Deputy Chairman of the Board, Mr. W. Hodkinson, gave a short address and answered questions*

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**Irish Air**

" The air in Dublin is no cleaner than that in the average industrial areas in England, and is very similar to that in Coventry. Conditions in Cork approximate to those of Bristol, while Belfast would seem to be nearly as dirty as Dublin and Cork together."—*J. E. Coolican, Surgeon, Mercer's Hospital, speaking to the Biological Society, Dublin.*

**N.C.B. Smokeless Fuel**

Mr. Alfred Robens, the new Chairman of the National Coal Board, has stated that the new smokeless fuel made by the Board (popularly referred to as the " Bronowski fuel ") will be introduced within the next few months, and that it is unlike any other, having, in Mr. Robens's words " no ash and a bright red flame of the kind produced by the old type of coal ".

# SMOKE AND CANCER

## *New Statistical Study by Dr. Percy Stocks*

"ON the Relations between Atmospheric Pollution in Urban and Rural Localities and Mortality from Cancer, Bronchitis and Pneumonia, with Particular Reference to 3:4 Benzopyrene, Beryllium, Molybdenum, Vanadium and Arsenic." This is the full title of an important new statistical report by Dr. Percy Stocks, published in the *British Journal of Cancer* (Sept. 14, 1960, 397-418), the official journal of the British Empire Cancer Campaign.

The author's summary of the paper is as follows:

Lung cancer mortality is strongly correlated with smoke density in the atmosphere in 26 areas of Northern England and Wales, in 45 districts of Lancashire and the West Riding of Yorkshire, and in 30 county boroughs, whilst similar though weaker correlations are found within Greater London. These relations are only partially explicable by social differences in the populations concerned. Bronchitis and pneumonia in males and bronchitis also in females show similar strong correlations with smoke. Cancers of the stomach and intestine are related significantly with smoke in the county boroughs, and cancers of sites other than lung and stomach in males are so related in the other groups of areas. In females cancers of the breast and other organs show no association with smoke. Pollution by larger particles is related significantly with lung and stomach cancers and bronchitis in 74 districts of Lancashire and the West Riding.

In the 26 localities the smoke samples were analysed in respect of polycyclic hydrocarbons and a statistical process of successive elimination was applied to discover which hydrocarbon was responsible for the smoke correlation with mortality rates. For lung cancer and bronchitis 3:4 benzopyrene emerges clearly as the substance of prime importance, with 1:12 benzoperylene contributing weakly for lung cancer, but for pneumonia 3:4 benzopyrene is apparently not important. The composite group of other cancers in males is correlated with several hydrocarbons, but cancers of the breast and other sites in females show no relations with any of them.

In 23 localities spectrographic analyses for 13 trace elements were made and a similar process of successive elimination was applied to those which showed appreciable correlations with mortality rates. For lung cancer beryllium and molybdenum emerge as the elements of most consequence, with arsenic, zinc and vanadium showing weaker associations. For bronchitis molybdenum appears to be the important element in both sexes whilst in males beryllium, arsenic, vanadium and zinc may also be concerned as for lung cancer. For pneumonia, beryllium emerges as the important element in both sexes, with vanadium also concerned in males. With other cancer in males beryllium, molybdenum and vanadium show associations, but breast and other cancers in females show no relations with any element.

### Medical Comment

This paper was discussed in a leading article in *The Lancet* of February 4th, 1961, the conclusions of which may be quoted:

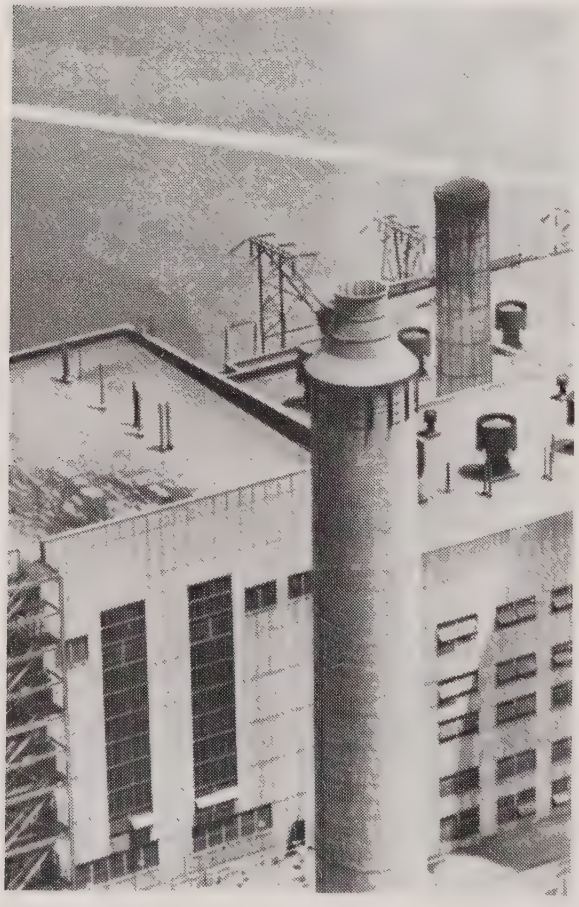
"Statistical studies of this kind cannot alone establish an aetiological relationship. Nevertheless the one hydrocarbon which emerges from Stocks's work as statistically related to mortality has long been recognized as a potent carcinogen in laboratory animals. It has also been identified in significant amounts in tobacco smoke.

Short of experiments on human beings it is difficult to see how the case for causal connection can be clinched. Only one form of human experiment is thinkable: we can watch the effect of removing this toxic constituent from the atmosphere of our towns. The demand for cleaner air is gaining impetus every year that passes. It is as well therefore that Stocks has been able to collect his data before the situation in many districts has changed materially. His results suggest that in due course we can expect a reduction in lung-cancer mortality in the smokeless zones and the smoke control areas of the country: provided (and it is an important reservation) that the other highly relevant factor—tobacco smoking—does not meanwhile gain enough added strength to offset the benefit of clean air."

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**Stainless Steel Stretches Smokestack**

When faced with a need to heighten their 214 ft. chimney by another 100 ft. the Pennsylvania Electric Company found that it could not readily be effected. *Atlas Steel News* reports the alternative adopted: a 10-ton stainless steel nozzle was attached to the top of the chimney. By choking down the stack diameter in this fashion the velocity of the exhaust gases was correspondingly increased, adding to the effective stack height.



Because the chimney has a brick liner and an outer concrete shell, with a cavity between, the nozzle has an inner skirt attached to the brick liner by a flexible diaphragm of " Viton " synthetic rubber.

With an additional fan pressure of only 2 in. w.g. the nozzle projects 485,000 c.f.m. of gas 100 feet or more above the chimney top—" stretching " its effective height virtually 50 per cent.

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**Ignorance and Prejudice**

" As the writer has previously stated, ignorance, prejudice and vested interests will have to be overcome before clean air becomes an established fact over the whole country and misunderstanding and even deliberate misrepresentation will have to be faced.

" As regards ignorance and prejudice I am astounded at the large number of citizens including the professional, technical and managerial categories, who, after being given the facts from their own neighbourhood of the menace, are completely unmoved by, or even deliberately opposed to, the idea of clean air. As regards domestic smoke production, many of the worst offenders in the town belong to these categories, whereas one would expect them to be among the first to appreciate the immense benefits which clean air offers."—*Dr. H. L. Settle, Medical Officer of Health, Doncaster, in his Annual Report for* 1958. (*Dr. Settle is now M.O.H. for Fulham.*)

# U.S.S.R. Studies of 3:4 Benzpyrene Pollution

## Review by R. E. Waller

**Atmospheric Pollution by the Carcinogenic Substance 3:4-Benzpyrene. By L. M. Shabad and P. P. Dikun, Leningrad, Medgiz, 1959. Translated, 1960 by B. Haigh.***

Interest in the presence of traces of carcinogenic hydrocarbons in the air has become widespread in the Soviet Union during the past ten years as well as in Great Britain and the United States. In this monograph the whole problem of atmospheric pollution and lung cancer is discussed at great length. The most useful features included in it are the detailed reports of measurements of 3:4-benzpyrene made in Soviet cities and the general conclusions on the sources of this compound, its importance in relation to lung cancer incidence and the feasibility of control. These sections have been collected together in Part A of the translation, and the remainder is available as Part B.

The Soviet workers have taken advantage of the mantle of snow which remains undisturbed on the ground for long periods in many parts of their country to provide a simple sampling tool. They have collected the snow, with its entrained pollution, and after determining the amounts of 3:4-benzpyrene, the results have been used as a basis for comparison between different places. The method is, however, open to criticism, for it deals mainly with "deposited matter," whereas it is the "suspended matter" in the air which is important in relation to health. Some measurements have been made by the more appropriate "aspiration" method and these results can be compared directly with those from other countries. In general the concentrations of 3:4-benzpyrene appear to be much lower in Soviet cities than in comparable British ones. There is an intriguing report accompanied by a photograph (in Part B) showing clouds of smoke billowing over the village of Buroz, where an old coking plant used to emit so much tarry material that there was up to 0·4 mg./m.$^3$ of 3:4-benzpyrene in the general atmosphere of the village. No special attempt has been made to study the lung cancer incidence there, but there is no evidence of outstanding differences. A comparative study is in progress in Siberia, where conditions in the old town of Irkutsk are being compared with those in the new town of Angarsk. The latter has been designed with district heating serving most of the residential area and with a strip of woodland separating it from the industrial area so that there is virtually no pollution from heating appliances.

The authors have not considered cigarette smoking in detail in this monograph, but they report the presence of 3:4-benzpyrene in the smoke from Russian cigarettes.

* Xerographed copies of translator's text issued in two parts, price £2 each. Translation No. NLL/24/4/SHAB, D.S.I.R. Lending Library Unit, 20 Chester Terrace, London, N.W.1.

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**Clean Air Council for Scotland**

Sir David Anderson has retired from the Chairmanship of the Council and has been succeeded by Bailie George A. Snodgrass, T.D., a member of Glasgow Corporation. Bailie Snodgrass's interest in clean air is of long standing and he has represented his city at many of the Society's Scottish and national conferences.



*Courtesy Glasgow Herald*

## Good for Glasgow

This " smokeless air " photograph of the heart of Glasgow—George Square, with the City Chambers in the foreground—shows the effect of the smokeless zone. It gives support to the statement recently made by the President of the Glasgow Chamber of Commerce, Mr. W. Hope Collins, who in an address to the Chamber said:

" During the last fortnight when we have been subjected to our usual foggy weather I think we have all been much gratified by the effect the smokeless zone has had in the centre of the city. I think many of us were a bit dubious as to whether the smokeless zone in the centre would have much effect until almost the entire industrial area of Glasgow had been similarly treated. There is no doubt, however, that during a foggy period the area where smokeless fuel is used is pretty immune to the worst effects of the fog. I know that in my own concern in Cathedral Street it has been a very pleasant surprise to come through a pretty dirty fog patch on the surrounds of Glasgow into a clear area where one has to spend one's working day. There is no doubt at all that the spread of this smokeless zone should add, not only to the health and happiness of people, but I think to increased productivity, and I hope that we shall be able to enlarge these smokeless zones as fast as it is economically possible to do so."

# INTERNATIONAL SECTION

*Sweden*

## THE TRACKING OF POLLUTANTS IN THE ATMOSPHERE

*by*

***Dr. Bertil Wedin***

*Director of Research, F.O.A.*

*In this article the author describes the work being done in Sweden on the dispersal of pollutants in plumes by the release in stack gases of fluorescent pigments, their collection on impactors mounted on aircraft, etc., and counting under ultraviolet illumination. Examples of such surveys are illustrated*

ENERGY production in Sweden by the " wet way " (water power) is more than three times greater than that produced by the " dry way " (coal and coke). With reference to air pollution this is a great advantage over countries which have to produce the major part of their energy from coal. But Sweden is not free from air pollution problems. At the International Clean Air Conference 1959 in London, Professor Cyrill Brosset made a contribution on a planned investigation of air pollution in Gothenburg. A recent list of Swedish research in the field of air pollution shows that such work is done at 14 institutions. The Press has become more and more interested. The government, however, has not yet considered the situation serious enough for centrally concentrated action. A motion in the Swedish parliament for an investigation of the influence of air pollution on man is to be proposed during the present session.

In combination with military technical investigations a team* organized at the Research Institute of National Defence, Stockholm, (FOA) has made some concentration measurements of sulphur contained in air impurities from two adjacent industries in the middle of Sweden. The purpose of this investigation was

1. to study the horizontal and vertical extension of drifting air pollutants from smoke stacks, slag-stacks and ground furnaces of these industries under a number of different weather conditions; and

2. to determine concentrations of sulphur compounds in different places and from what industry they are derived. The investigation, not yet completed, is made by tagging the air with a fluorescent tracer substance in aerosol form.

In order to determine directions, widths and concentration distributions of aerosol plumes, field tests using fluorescent pigments have been made in different areas of the world, for instance in the Los Angeles basin. A very valuable method has been developed by Braham, Seely and Crozier (Trans. Amer. Geophys. Union, **33**, 1952).

Their method is based on the following three points;

(*a*) a fluorescent pigment is dispersed in aerosol form,

(*b*) particles are collected by impactors at different points or from certain flight paths at a right angle against the drifting plume, and

* The team consists of Professor Frõssling, Assistant Professors Aurivillius and Lindgren, Staff Meteorologists Nordstrõm and Wickerts, and the author.

(*c*) the impactor collections are illuminated by ultraviolet light. By counting the fluorescent particles under the microscope the concentrations of the aerosol in different cross sections of the plume can be calculated.

**Method and Apparatus for the Swedish Field-Tests**

The method published by the above mentioned authors was not considered quite suitable in all details for the actual Swedish investigations. Certain improvements were made. A new type of venturi tube apparatus for dispersion of the particles was constructed; two types of impactors were developed which permit great air velocity and consecutive separate samplings. An impulse generator for the impactor, as well as a counting device for storing information about the number of time intervals of varying duration registered, has also been constructed.

Before and during an experiment the meteorological situation is thoroughly studied both by the ordinary weather observation network and by temporary meteorological stations.

The pigment used was synthetic crystalline zinc-cadium-sulphide, in the following indicated by ZnCdS. The choice of particle size of the pigment is limited by the facts that the particles must be small enough for their sedimentation rate to be negligible, and that their fluorescence must be strong enough to allow identification of the particles. The greatest diameter of the pigment particles is estimated to be 20$\mu$. Larger particles have too great a settling velocity. The fluorescence obtained from the available pigments is not sufficient for identifying particles of smaller diameter than 0·5$\mu$. Suitable pigments are obtainable from England, Switzerland and U.S.A., *e.g.*, Helecon Fluorescent Pigment 2266. The disperser has a spreading capacity adjustable to 3·6 Kg./hour=1 g./sec. ($\pm$ 10 per cent.). In order to get a sufficiently stationary plume within the testing area and sufficient extension as regards the space and the time, the dispersals extend to 5-6 hours. (See Fig. 1).

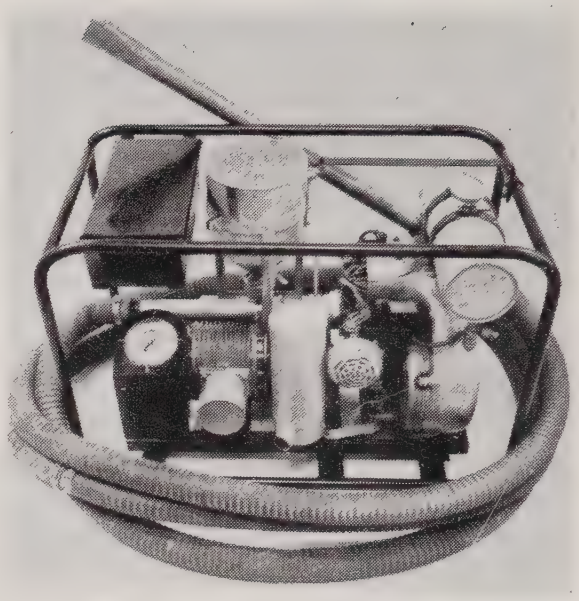


FIG. 1.—*The apparatus is designed for dispersion of similar substances for different experimental purposes. A petrol engine drives an air-compressor which gives a continual air flow of* 200 $m^3$*/hour through a venturi tube. This is shaped in order to give a high air velocity and a negative pressure, by which the powder is sucked from the container. By a dosing device it is possible to vary the input to give an effective output of e.g.* 1 *g/sec.*

The particles drift—invisible to the eye and harmless to vegetation, animals and man—over wide areas without any appreciable sedimentation. Certain precautions should be taken against inhalation of the tracer aerosol near the disperser for any length of time.

During and after dispersal samples of the air in the plume are continuously taken by impactor-equipped aircrafts, boats and motorcars. (See Fig. 2).

As collecting devices, different authors have proposed either filters (millipore filters) or impactors of varying types. Millipore filters have 100 per cent. filter efficiency for all particle sizes down to 0·05$\mu$. The impactors compared with the millipore filters have the advantages of continually recording and having the particles concentrated to small areas which facilitates the analysis. A disadvantage of the impactor is that the filter efficiency is dependant on the particle size. For the actual Swedish investigation, both millipore

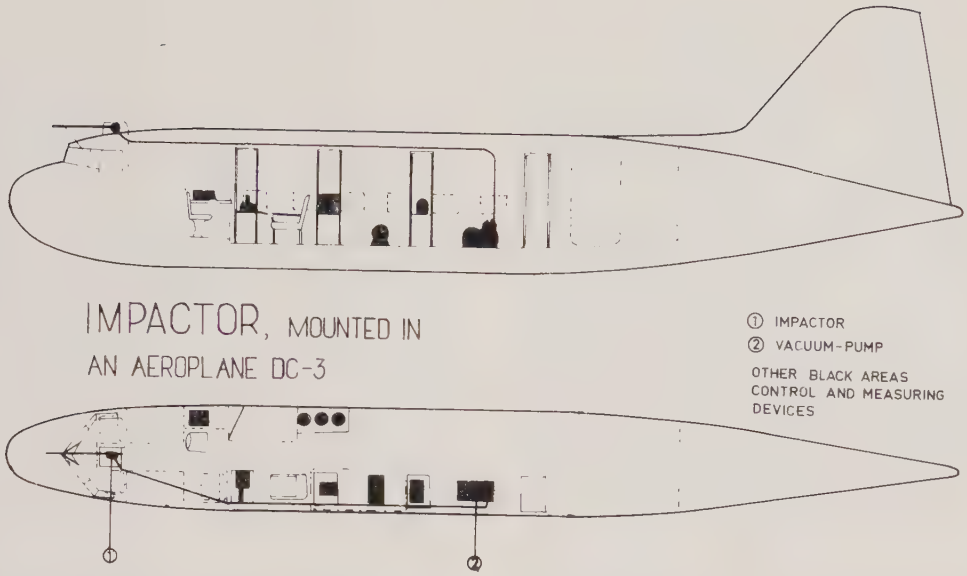



FIG. 2.—*For sampling in the air layer 30-3,000 m. an impactor with adherent automatic device has been installed in a twin-engined aircraft, type DC-3, equipped as an airborne laboratory*

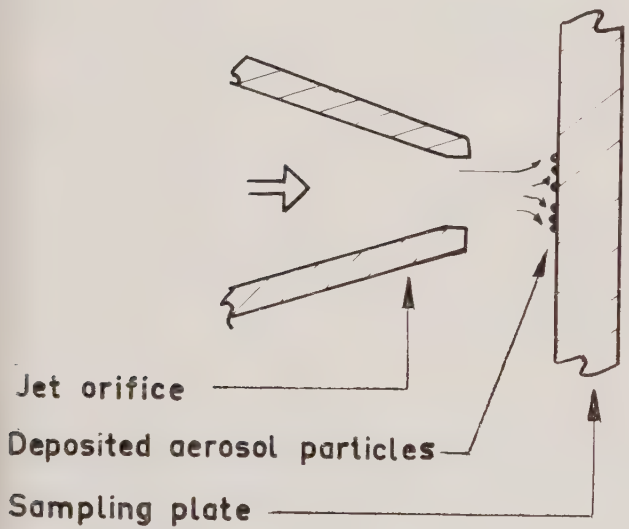



FIG. 3.—*Principal drawing of the impactor*

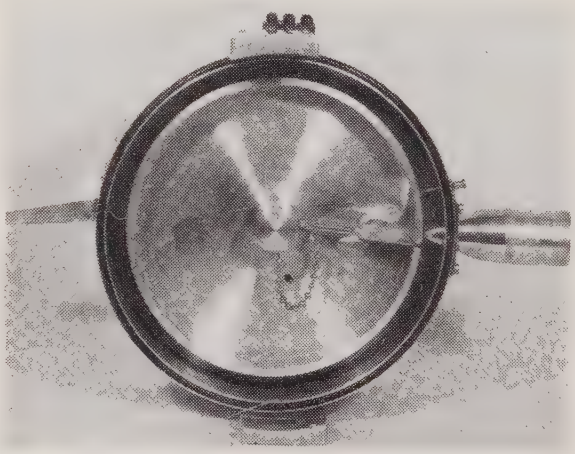


FIG. 4.—*Impactor with the lid removed. The nozzle is essentially the same shape as Casella's cascade impactor nozzle*

filters and impactors were used.

The impactors are of the following schematic construction. A jet of the particle-bearing air is sucked through a small fissure against a sticky strip on a turnable cylinder. The airborne particles are deposited on the strip in narrow ribbons. (See Fig. 3).

The study of foreign measurements shows that air velocities of 100 l./min. (litres per minute) are suitable for an impactor. In order to make it possible to work with a moderate vacuum and at the same time to get the particles collected on small areas, the impactor is constructed with a rectangular fence (1·5 x 0·08 cm.$^2$) which corresponds to the dimensions for step 3 in Cassella's cascade impactor. At 130 l./min. such an impactor requires a vacuum of about 200 mm. of mercury.

The filter efficiency of the impactor (based on particle counting) is $>$ 90 per cent. for velocities $>$ 70 l./min. (test aerosols of smaller mean diameter than those used in the field tests). The impactor glasses are coated with a layer of castor-oil resin. (See Figs. 4 and 5).

The strip is exposed to the jet within

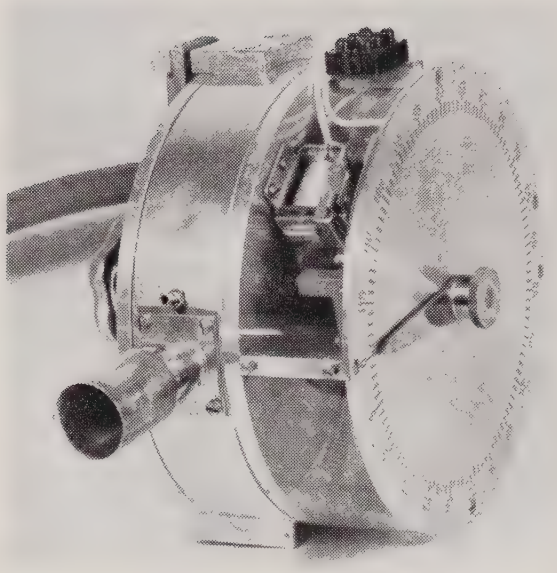


FIG. 5.—*The forward feeder turns the drum in steps of* 3°, *i.e. one revolution is divided into* 120 *steps and the distance between two consequent deposits will be app.* 4·2 *mm.*

fixed intervals of time, for aircraft 10-30 sec., for boats 0·5-3 min. and for motorcars 1-60 min. (See Fig. 6).

In order to direct the sampling vehicles to suitable places, windvector diagrams are made. At half-hour intervals the direction and the velocity of the wind is marked on a transparent paper by arrows which are drawn as to form a line. These diagrams are made for the wind at ground level as well as for higher altitudes. The vector diagrams are placed over a map with the origins over the dispersal point. Then a picture of the plume's situation is obtained. The picture is almost exact for the ground level. For higher altitudes the position of the plume is dependent on its velocity in reaching these altitudes.

Collecting schemes are made up for wind velocities up to more than 20 m./sec.

Both aircraft and boats survey the testing area within relatively wide angles as there may be shifts in the wind direction, and as the width of the plume as well as the central axis of it is unknown. It is also necessary to pay attention to the difficulties of determining the wind directions in the widely extended test area, and the possibility of different wind directions and velocities at different heights. It is also difficult to predict how quickly the material is moving between the different heights.

Information on the average direction of the air mass and the changes in it are given by the meteorologists in the team. The orientations for the pilots and drivers are transmitted by the leader of the experiment with help of different radiocommunications, when

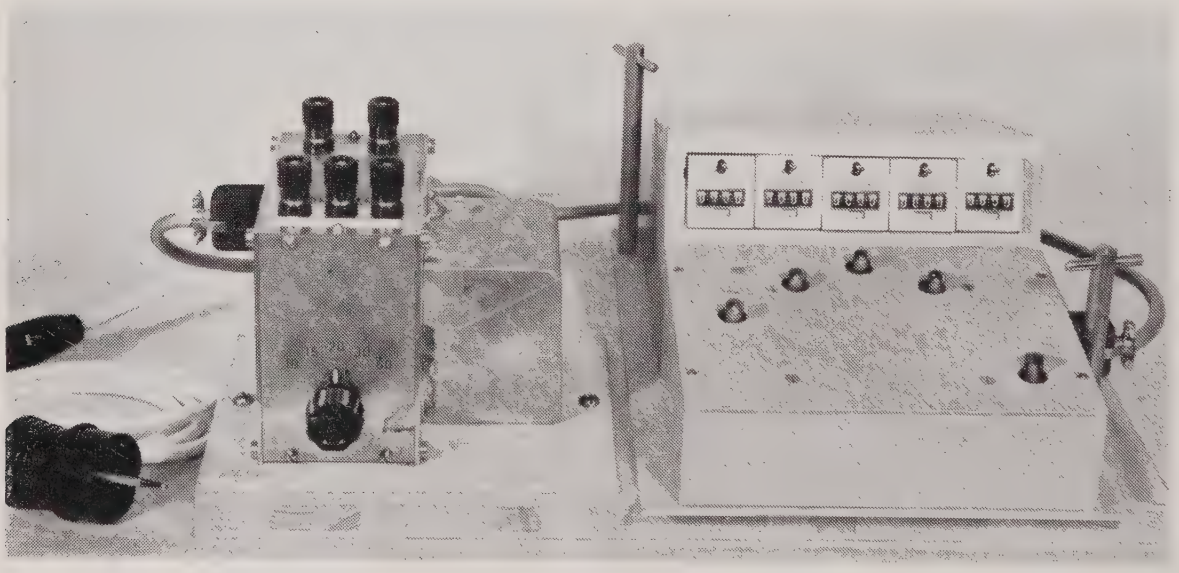


FIG. 6.—*When the impactor is used for sampling in an aerosol-cloud with varying particle-concentrations it may be desired to vary the sampling periods according to a time schedule. For this purpose the impactor can be connected to an impulse device which operates the impactor at 10, 15, 20, 30 and 60 secs. intervals. A connecting unit stores information about the numbers of such intervals of each kind as well as the total number*

the direction of the plume can be estimated for greater distances.

Every cross-section should be passed through by the aircraft at several different heights in order to:

1. make clear the general structure of the plume to get more exact knowledge about the laws of the turbulent distribution and thereby find out *e.g.*, the vertical mixing which is needed for the estimation of the effect of the wind screening,

2. obtain a measure of the total distribution of particles through the cross-section, enabling an estimation to be made of the number of the particles which have sedimented.

The analysis of the impactor collections includes the counting of particles under the binocular microscope. The counting is facilitated by a special stand for the microscope. The exposure of the film strip to UV-light is attained by two mercury lamps mounted in cylindrical lamp bodies. The focusing is made by common glass lenses. (See Fig. 7).

In order to get a correlation between the results obtained by the pigment method on aerosols and a conventional chemical method on a gas, the pigment dispersal in some tests was directed into a factory chimney (height 106 m., effective observed height 200 m.) with a continuous emission of large quantities of sulphur dioxide. The source strength of the chimney with respect to sulphur dioxide and the output of fluorescent pigment (expressed in grams/sec.) were known. Samples of sulphur dioxide and the tracer pigment were taken simultaneously by crossing the plume by aircraft at different heights and distances. Samping was avoided in those parts of the plume which were disturbed earlier by the aircraft.

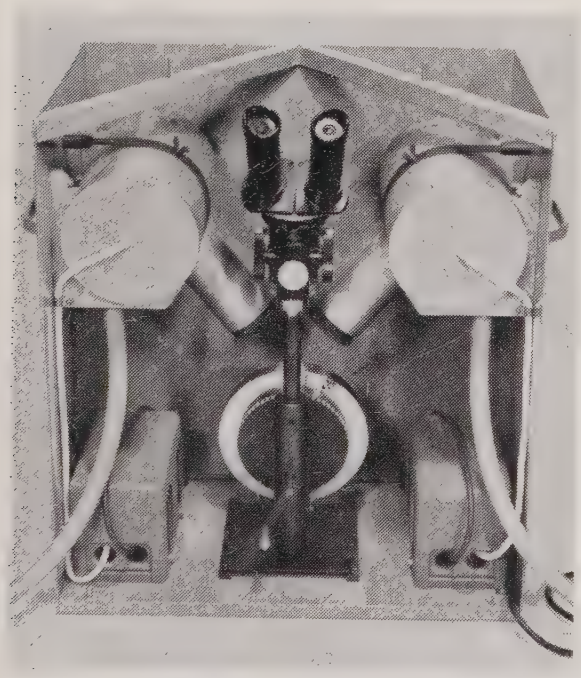


FIG. 7.—*Arrangement for the UV-illumination*

**Analysis of low contents of sulphur dioxide in the air**

For the examination of the correlation between concentrations and dose values, which have been received with the tracer method, and by chemical analysis of sulphur dioxide, a special method of analysis for $SO_2$ has been developed (Haglund, FOA). The $SO_2$ is absorbed by silica gel in tubes. At the same time it is oxidized by hydrogen peroxide. The absorbed material is extracted with distillated water and the sulphuric acid is determined by conductometric titration.

**Meteorological measurements**

Several different meteorological measurements are essential for the forecasts, *inter alia*, in order to decide the flight paths, to avoid collecting within areas already disturbed by the aircraft, and to obtain measured values for such parameters, as are necessary for the future working up of the data. Thus the mean wind direction and velocity must be known. Further it is important to know the vertical temperature gradient.

In addition to the common meteorological material, which is received by telefacsimile and telephone from forecast centres and the regular meteorological observation service, local measurements are required for determination of the vertical wind and temperature profiles within the actual experiment areas.

The actual ground sections are photographed from aircraft. Infor-

mation on the direction of the stack-smoke and cloud as well as visibility conditions, are transmitted from the planes by radio to the experiment leader.

Measurements by means of radio-sonds are performed during the experiments for determination of pressure, temperature and humidity. For these measurements instrument equipment of the Väisälä type, is used.

Measurements by means of wire-sonds are performed up to a height of 500-600 metres for determination of temperature and humidity. An instrument designed and constructed by FOA is used.

During the test the temperature within the lowest airlayers is registered by thermocouples fixed at several points along a wire stretching from the highest stack, down to the ground. (See Fig. 8).



FIG. 8.—*Thermocouples along a line fastened to the top of the left-hand chimney*

*Figures 9-11 are from a FOA report by Aurivillius-Wedin-Wickerts and demonstrate the combined plume of the stack-smoke and the tracer pigment under different meteorological situations at an industry situated in the middle part of Sweden. The pictures are drawn by Wickerts*

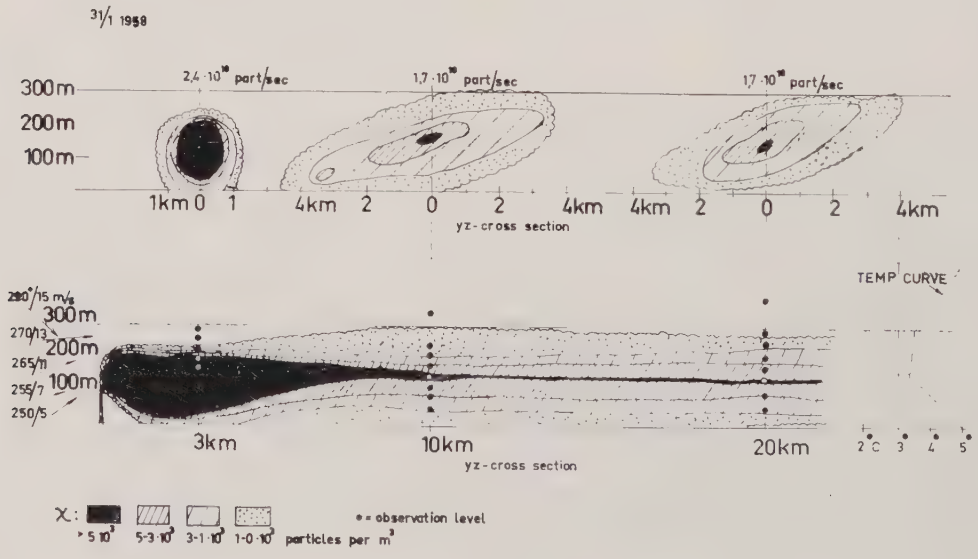



FIG. 9.—*On this day the stratification in the lower part of the atmosphere was quite stable with temperature inversion from the ground up to about 1,000 m. Strong inversion from 300 m. and upwards. The concentration near the ground is not very high even in the vicinity of the smoke stack, but the region of high concentrations extends very far at a level approximately equal to the effective height of the smoke-stack. No particles were found above 300 m., i.e. in the region of strong inversion. The black and white spots mark aircraft samples*

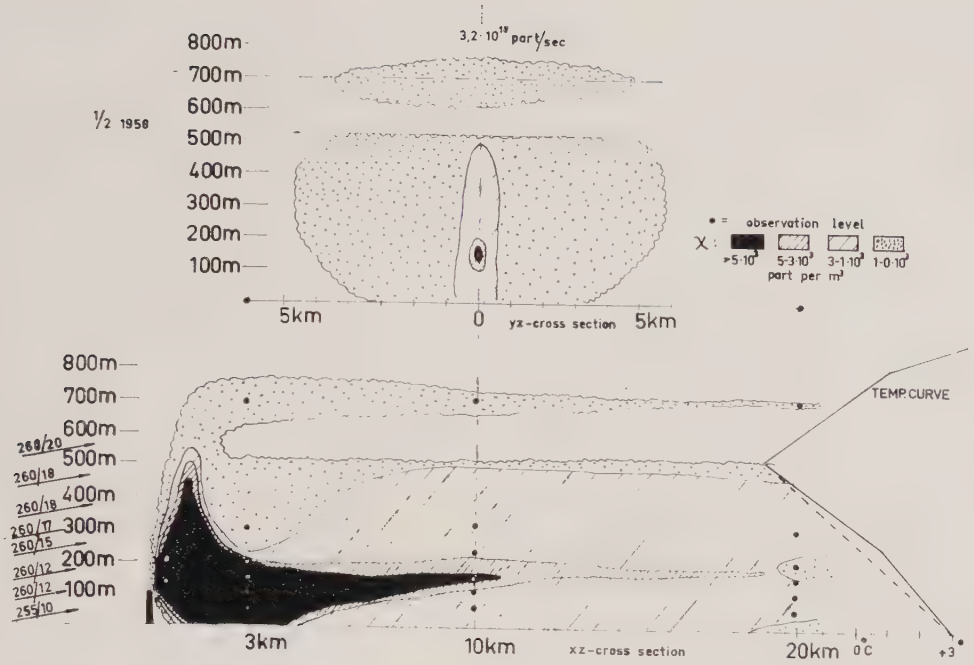



FIG. 10.—*On this day there was a temperature inversion at a height of about 500 m. below which the layering of the atmosphere was very unstable, i.e. the different layers were mixed thoroughly. From the longitudinal section of the plume it is seen that the particle concentration at the ground near the smoke-stack in this case is very much higher than the concentration during the experiment shown in fig. 9. The pollutants are comparatively evenly distributed in the whole region below 500 m. Immediately above the smoke stack the inversion boundary is penetrated by some pollutants*

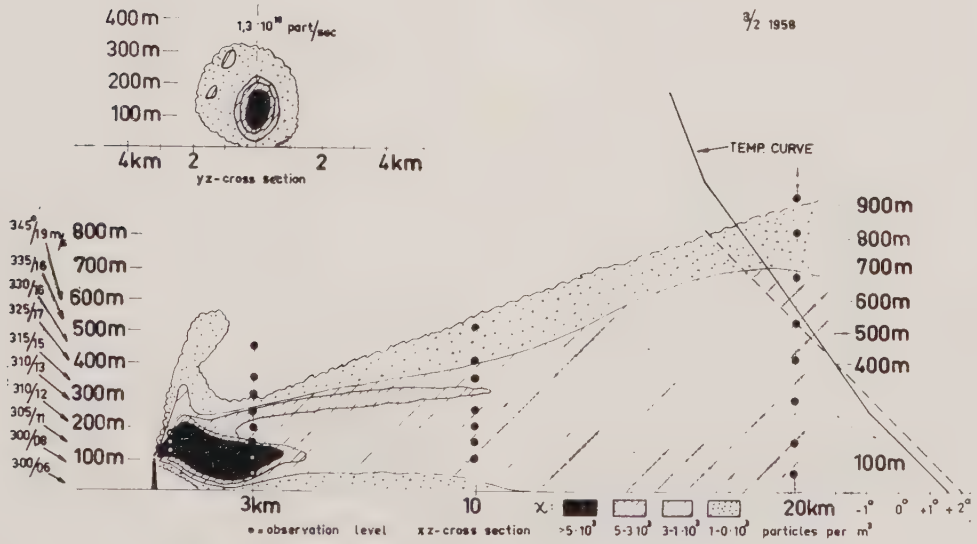



FIG. 11.—*Quite unstable atmospheric conditions with the temperature decreasing upwards give a high probability for convection currents and for an intermixing of the atmospheric layers from the ground up to considerable heights. The air pollutants are distributed in a very large voume and the regions with higher concentrations are more limited in this case than in the following cases. The upper boundary of the plume does not remain on a constant level but seems to be continuously increasing*

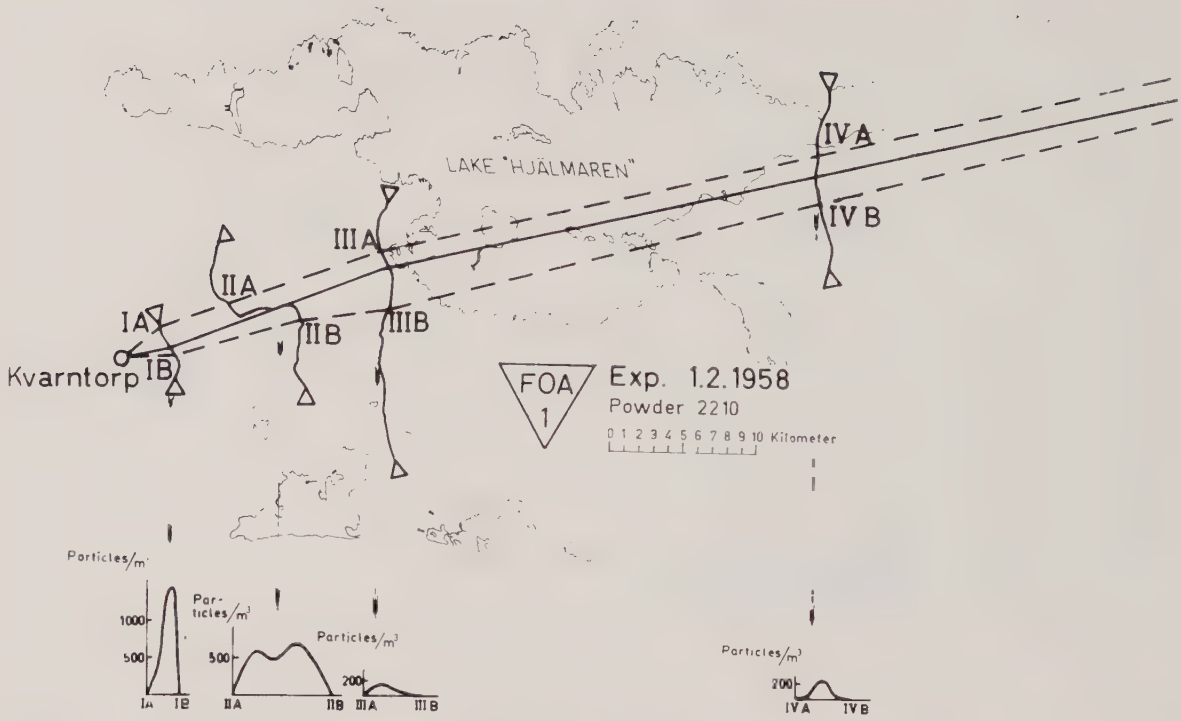



FIG. 12.—*The smoke plume from Kvarntorp on February 1st, 1958. On the roads I A-B, II A-B, III A-B and IV A-B samples were taken with impactors mounted on cars. The number concentrations on the different distances are figured in the diagrams*

*(Fig. 12 from a FOA report by Wedin. The picture is drawn by P. H. Lindgren)*

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*South Africa*

## CLEAN AIR BILL

### *(from Dr. E. C. Halliday of C.S.I.R.)*

A Bill for Atmospheric Pollution Prevention has been published in the South African Government Gazette and will be placed before Parliament during its present session. In many respects the Bill follows the provisions of the British Alkali Act and the British Clean Air Act. There is also a provision that where an area does not come under a local authority, or where a local authority is unable to institute the control of air pollution, then the Minister may empower a neighbouring local authority to maintain a control of the emission of the pollutants (on the ground that the pollutants from one area can move into another area).

As an alternative, it is possible for the Minister to authorize the chief officer responsible for the control of emissions from factories, to undertake the control of the emission of smoke. In this way we hope to prevent a situation arising where a large producer of smoke escapes control measures because he is not in a control area.

**Research**

On the research side we now have a research fund which has reached the figure of £8,000 a year for five years and in which local authorities, industry and Government are participating. We are aiming at over £20,000 a year, so have a long way to go yet. The first aim is to find the potential market for solid smokeless fuel which will be created by smoke control measures, for in South Africa there is at present almost no coke industry which could supply the small user of fuel, and low

temperature coke does not exist. When we have found out what the potential market is we will be able to advise industrial concerns and encourage them in starting up the manufacture of low temperature coke. Our next aim is to make a study of the invisible and at present unknown pollutants in the air of our larger cities so as to find out what the nature of the pollution situation is. The smoke situation is easily visible and the legislation should deal with it, but we wish to be prepared for the developments which will arise from the new forms of technology.

*Italy*

## RESEARCH IN MILAN

A brief note in our last issue on the summaries received of reports published by a number of workers on the investigation of air pollution in Milan, may be followed by more detailed references. Carried out by the Provincial Administration of Milan the English summaries of the papers have been prepared by the Documentation Service of the Sanitary Engineering Institute of Milan. Space considerations prevent the printing of the summaries of the 26 papers, covering the years 1957, 1958 and 1959, but the subjects and research projects covered are listed as follows.

**1957**—Description of microchemical absorption apparatus for gaseous pollution. Portable unit for quantitative determinations of sulphur dioxide, nitrous oxide, ammonia, aldehydes and lead; and results of such analyses. (Further reports given in 1958 and 1959). Study of fumes from electric furnaces for steel, cast iron and manganese iron. Measurements of radio-activity. Measurement of dust deposits and influence of climatic factors. Spectrophotometric determination of $NO_2$ with apomorphine.

**1958**—Estimation of 3:4-benzpyrene in Milan atmosphere and monthly measurements. (Ranging from 23·1 g. in 100 m.$^3$ air, in January, to 0·29 in August). Determination of sulphuric acid content in the air by a gravimetric method. Concentration of dust in air of Milan. Lead, zinc, copper and iron constituents of dust deposits at various stations. Speed of dispersal of effluents and ground level concentration for single chimneys and for aggregates of chimneys. Radioactivity measurements.

**1959**—Survey of the various problems connected with the study of pollutants and summary of approach being made. Study of oxidation of olefines in the presence of sulphur and catalytic action with traces of nitrous oxide. Quantitative and chromatic separation of polycyclic hydrocarbons in atmospheric dusts. 3:4-benzpyrene measurements in Milan atmospheric dust and from various sources. (Not found in soot and smoke from naphtha burning, but found when coal is burnt, the quantity increasing with increasing volatile matter content of the coal. Determination of arsenic in Milan atmospheres dust. Determinations of hydrogen sulphide, hydrofluoric acid, chlorine and amines. Radioactivity measurements.

The summaries of any of these reports, with authors and references, may be obtained from the Society on request.

*Poland*

## INVESTIGATIONS IN KATOWICE COUNTY

### *(from Dr.med. Juliusz Kepski)*

Since June, 1959, a long-term investigation of air pollution in the county of Katowice has been in progress. This is being carried out by the Sanitary Epidemiological Station on behalf of the local authorities of the Public Health Service, with the support of the Executive Committee of the P.Z.P.R. party. Forty-eight officials are carrying out the work.

Two-hundred measurement sites—now increased to 205—were selected

in the area of the county, based on the following considerations:

1. The net of measurement sites should be so organized as to give an estimate of the pollution of the individual towns, and eventually the different districts of the more industrialized cities.

2. The sites should supply material which would make it possible to determine the maximum and minimum deposits within the county.

3. The results should provide a foundation—taking wind and other meteorological factors into account—for determining the influence of separate industrial establishments, and eventually groups of such establishments, in the state of pollution in their respective neighbourhoods.

**Method**

Deposit collecting vessels of the Weck type (about 570 cm.$^2$ surface) are hung on telegraph posts three metres above the ground. They are changed at monthly intervals. A certain amount of loss has been caused by breakages, theft and through soiling visible to the naked eye.

The deposits are analysed for dry residue (g. per m.$^2$ per month), tarry matter, inorganic matter, loss on ignition, iron, and sulphur.

It is recognized that these observations give no information on daily fluctuations, nor on maximum pollution. The method is limited to the so-called "heavy aerosol," and the results differ according to meteorological factors as well as siting differences. Nevertheless the method is adequate for establishing orientation results. For the full pollution picture more exact methods are required. The first 24 months observations cannot provide an adequate foundation for drawing any general conclusions.

The observations will however have an objective value in giving certain information, and the fact that measurements on such a scale have been started is in itself most significant. The project is also of value in the experience it provides for the young staff of the Sanitary Epidemological Service.

*U.S.A.*

## PUBLIC HEALTH SERVICE ORGANIZATION

***(from Arthur C. Stern)***

Air pollution activities within the Public Health Service (of the Federal Department of Health, Education, and Welfare) have been re-organized as from September 1st, 1960, with the creation of a new Division of Air Pollution in the Bureau of State Services of PHS. This consolidated the previous air pollution engineering activities in the Division of Engineering Services and air pollution activities in the Division of Special Health Services.

The chief of the new division is Mr. Vernon G. MacKenzie, formerly Assistant Chief for Research and Development in the Division of Engineering Services. The Deputy Chief is Dr. Richard A. Prindle, formerly Chief of Air Pollution Medical Activities in the Division of Special Health Services. Mr. Ralph C. Graber, who was formerly Chief of Air Pollution Engineering Activities in the Division of Engineering Services, became Assistant Chief in the new division. All these persons are located in Washington. The research and technical assistance activities of the division, which are principally centred in Cincinnati, Ohio, are now organized into a Laboratory of Engineering and Physical Sciences (LEPS) with Mr. Arthur C. Stern as Chief; a Laboratory of Medical and Biological Sciences with Dr. Otis Emik as Chief; a Field Studies Branch with Dr. R. O. McCaldin as Acting Chief; and a Technical Assistance Branch with Mr. Jean J. Schueneman as Chief. In addition, a new Research and Training Grants Branch located in Washington, was created with Dr. Maurice Bender as Chief.

*U.S.A.*

## NATIONAL GOALS

The U.S. Department of Health, Education and Welfare has published a 40-page report of the Surgeon-General's "Ad Hoc Task Group on Air Pollution Research Goals." In the report the committee recommended that financial support of air pollution be increased from a current estimated level of $11 million annually to about $32 million a year by 1968. The ten men committee further recommended that the Federal Government assume 40 per cent. of this cost, industry 28 per cent., and State and Local Governments 32 per cent.

The committee recommended these ten national goals for the 1960-70 decade:

1. Determine the effects of air pollution on human health.
2. Determine the effects on the nation's agricultural economy resulting from air pollution damage to animals and crops.
3. Find better ways of measuring the economic loss from air pollution damage to materials, and soiling, and reduced visibility.
4. Find better ways of measuring and identifying air pollutants at their source and in community air.
5. Develop better techniques for assessing meteorological factors affecting air pollution.
6. Learn, through research, more about the formation of new pollutants from reactions in the air.
7. Expand our nationwide air pollution monitoring efforts.
8. Develop new methods and equipment for controlling the sources of air pollutants.
9. Build and disseminate a comprehensive body of knowledge related to the technical, legal, economic, and administrative aspects of air pollution.
10. Evaluate the legal and administrative practices related to air pollution control.

*Other Publications*

Among other publications received from the U.S.A. are an important technical guide for the measurement and control of *Atmospheric Emissions from Petroleum Refineries* published by the Public Health Service of the U.S. Dept. of Health Education and Welfare. Also published by the Service is a brochure on forecasts of air pollution conditions. This describes a scheme which is in effect an extension of the meteorological service, linking up with weather conditions and trends throughout the country in a form that will make it possible for research workers, etc., to obtain forecasts of the air pollution situation in any area. The service is not intended for general publication.

Another publication is a special 40-page report on *Air Pollution*, published by *Power*, the McGraw-Hill technical monthly. The text is full, informative and well-balanced, but is unfortunately overshadowed by a distracting format and diagrams that have been so simplified that it is difficult to appreciate their purpose.

*France*

## I.F.C.E. BULLETIN

We have received from the Institut Francais des Combustibles et de l'Energie the third issue (December, 1960) of their air pollution information bulletin (duplicated). This contains abstracts, reports on recent conferences, surveys of legislation in France, Germany, Britain, U.S.A. and Belgium, and a review of Press comment. The conference reports are on the "Eurotox" conference at Royaumont (France) in April, 1960, the N.S.C.A. conference at Harrogate, and the V.D.I. Air Pollution Commission conference at Weisbaden in September.

*Belgium*

## ROAD VEHICLE POLLUTION

From 101, Rue Royale, Brussels, 1, we have received the September and December, 1960, issues of *Technical Aspects of Road Safety*, the Information Bulletin of the International

Centre of Information on Motor Vehicle Inspection Techniques (C.I.D.I.T.V.A.). The September issue contains an important article on the detection of diesel smoke by F. P. Maschaert. This describes different methods and techniques for measuring diesel smoke, with results of tests carried out in Belgium. The apparatus tested includes the British Hartridge Smokemeter. There is a summary in English.

The December issue contains a series of articles on various aspects of road safety, including one on air pollution by M. L. F. Ardouille.

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**CLEAN AIR ACT 1956**

**SMOKELESS ZONES**

**DON'T FORGET TO ATTEND THE**

**PUBLIC MEETING**

**at the Town Hall, Halifax on Wednesday, Jan. 25, 1961, at 7-30 p.m.**

●

**This is your last chance to defend your coal fire and your liberty in the home**

## Whose?

The above advertisement, measuring 5½ in. square appeared in the *Halifax Daily Courier* of January 23rd. Looking at first sight like an official announcement under the Clean Air Act, it will be seen that it gives no indication of the persons or body responsible for it. As it is so outstandingly misleading and question-begging it is not surprising that those concerned should wish to remain anonymous.

The meeting was well-attended, and no doubt, thanks to the advertisement, brought in all who dislike the idea of clean air. The Mayor, Alderman Douglass Robinson, was in the Chair, and after an opening address by the Director of the N.S.C.A., the meeting was open to questions. On the platform to answer them were the Deputy Town Clerk, the Deputy Medical Officer, the Chief Public Health Inspector, and representatives of gas, electricity, and coke. The advertisement was sharply criticized, and an N.C.B. representative assured the meeting that his Board was not responsible. A representative of the Coal Merchants' Federation spoke, declaring that "we in Yorkshire still like a coal fire," but making no mention of the advertisement.

It has also been reported that an anonymous stencilled letter was distributed by hand by a coal merchant to residents in one proposed smoke control area. The letter urged opposition to smoke control, and declared "If the proposals of the Council are implemented, it will mean using manufactured fuels and/or costly other forms of domestic heating—YOU WILL BE DENIED THE FREEDOM OF YOUR OWN CHOICE."

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### Air Pollution Progress Review

A "Progress Review No. 48: Air Pollution", by Arnold Marsh, Director of the N.S.C.A. was published in the Journal of the Institute of Fuel, December, 1960. The review outlines the present situation and progress made since 1950, mainly from the background of the Beaver Report and the Clean Air Act. The investigation and measurement of air pollution are briefly discussed, followed by a review of the Act and progress being made under it in the industrial and domestic fields. Transport pollution, mainly that from road vehicles, and the problem of sulphur emissions are also discussed and the review concludes with a note on air pollution as an international problem.

A limited number of reprints of the review are available from the Society, price 9d. each, post free.

*In Parliament*

## Questions on Diesel Smoke

**Mr. F. Noel-Baker** asked the Minister of Transport what steps he will now take to prevent the poisoning of the air in large towns by fumes from motor vehicles, including visible smoke from diesel engines, to enforce the testing of engines which have been observed by police officers to emit excessive or unnecessary smoke, and to require the necessary adjustments or improvements to be made to such engines; and whether he has studied regulations on this subject now in operation in the City of Durban, proposals for similar action in the State of California and a report by Mr. Douglas Lister to the annual conference of the National Society for Clean Air at Harrogate on October 5th last at which his Department was represented, copies of which have been sent to him by the hon. Member for Swindon.

**Mr. Marples:** It is an offence to emit smoke or fumes from any vehicle if this might cause damage to property or injury or danger to people; the police can, and do, prosecute offenders. Many of the pollutants, especially invisible ones, are, however, difficult to measure. Officers of my Department have power to prohibit the use of unfit goods vehicles and buses, and, when the opportunity arises, urge on those concerned the importance of correct driving and maintenance to reduce fumes; their efforts are having some success. We study all proposals in this field and keep in touch with developments overseas. I have recently circulated a proposal to amend the law to ensure that the excess fuel device cannot be misused to obtain additional power while driving, *e.g.* on hills, at the expense of clouds of black smoke.

**Mr. Noel-Baker:** While thanking the Minister for taking a close interest in this very important matter, may I ask him if his Answer indicates that rings are being run round the law if it is really an offence to emit poisonous fumes? As he knows, in all big cities there is a very high concentration of carbon monoxide, 3-4 benzpyrene and other highly dangerous and poisonous substances. This is becoming a growing problem. Can he assure us that he is looking at it very carefully indeed and watching the increasing concentration of these poisonous gases in our cities?

**Mr. Marples:** I can assure the hon. Member that I am very concerned about this problem. The difficulty is to get a technical device which can measure it. No country in the world has yet succeeded in doing that, but we are keeping in close touch with California. As soon as anyone gets a satisfactory device we shall look at it and try to get one of our own. (*Hansard, December 20th, 1960*).

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### Jet Plane Pollution

"The take-off of one commercial jet liner has been estimated to create a quantity of air pollution equivalent to that produced by 6,850 passenger cars."—*Lauren B. Hitchcock, speaking to the American Institute of Chemistry.*

### Concessionary Coal

There have been Press reports that an agreement has been made between the N.C.B. and the N.U.M. on the question of concessionary coal in smoke control areas, and that a sum of £42 7s. a year will be paid to each miner in lieu of concessionary coal. We understand that the matter is not yet settled and is still being discussed.

### Bristol News

The September 1960 issue of the Corporation's *Civic News* was devoted to clean air, including an informative article and telling comparative photographs.

### Sheffield Report

The Health Education Service has issued a detailed report on the excellent publicity and educational campaign carried out in the Gleadless district, for which a smoke control order has been made. We recommend a study of this report by all concerned with the initiation of similar activities.

### "Livability in Towns"

Speaking on this subject to a recent meeting of SPUR (Society for the Promotion of Urban Renewal), Mrs. Mary Smith, senior housing manager to the Crown Commissioners' Estates, said that she hoped that clean air on housing estates would become general as the result of the application of the Clean Air Act.

# SMOKE CONTROL AREAS

## Progress Report

### POSITION TO DECEMBER 31st, 1960—TOTALS

| | England and Wales | Scotland |
|---|---|---|
| **Smokeless Zones** (Local Acts) in Operation .. | 44 | 1 |
| Acres, 3,400 | | |
| Premises, 41,060 | | |
| **Smoke Control Areas in Operation** .. .. | 261 | 9 |
| Acres, 36,707 | | |
| Premises, 241,504 | | |
| **Smoke Control Orders**— | | |
| Confirmed .. .. .. .. .. | 117 | 5 |
| Submitted .. .. .. .. .. | 166 | 3 |
| Proposals Notified† .. .. .. .. | 266 | 16 |
| **Grand Totals** .. .. .. .. | 854 | 34 |

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Winter, 1960), which gave the position up to September 30th, 1960. They now show the changes and additions to December 31st, 1960.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

### ENGLAND AND WALES

#### New Smoke Control Areas in Operation

Acton B. Nos. 1 to 3, Aireborough U.D. No. 3, Bethnal Green M.B. No. 1, Bradford C.B. No. 1, Bromley B. Nos. 1 and 2, Brownhills U.D. No. 1, Camberwell M.B. No. 1, *Chadderton U.D. No. 1, Chelsea M.B. No. 1, Chingford B. No. 1, Deptford M.B. No. 1, Doncaster C.B. Nos. 2 to 5, Dudley C.B. No. 3, Ealing B. No. 2, East Barnet U.D. No. 1, Edmonton B. No. 2, Failsworth U.D. No. 1, Fulham M.B. No. 3, Gateshead B. Nos. 1 and 2, Greenwich M.B. No. 1, Hackney M.B. No. 2, *Heston and Isleworth B. No. 1, Holborn M.B. Nos 2 and 3, Hornchurch U.D. No. 2, Ilford B. No. 1, Jarrow B. No. 1, Kensington M.B. No. 3, Kingswood U.D. Nos. 1 and 2, Lewisham M.B. No. 4, *Luton B. No. 1, Newcastle-upon-Tyne C.B. No. 2, Nottingham C.B. No. 2, *Old Fletton U.D. Nos. 1 and 2, Paddington M.B. No. 2, Prestwich B. No. 3, Richmond (Surrey) B. No. 1, Rotherham C.B. Nos. 8 to 10, St. Marylebone M.B. No. 3, St. Pancras M.B. No. 2, Salford C.B. Nos. 2 and 4, Sheffield B. No. 6, Staines U.D. No. 1, Stepney M.B. No. 1, Stoke Newington M.B. No. 4, Wakefield C.B. No. 1, Wallasey C.B. No. 3, *Wath-upon-Dearne U.D. No. 1, Westminster M.B. No. 3, Willesden B. No. 2, Wilmslow U.D. No. 4, Wood Green B. No. 2, Woolwich M.B. Nos. 5 and 6, Yiewsley and West Drayton U.D. No. 1.

#### New Orders Confirmed but not yet in Operation

Aldridge U.D. Nos. 2, 3 and 5, Beddington and Wallington B. Nos. 1, Bredbury and Romily U.D. No. 1, Brierley Hill U.D. No. 11, Carshalton

† The " Proposals Notified " grouping will be discontinued after this issue. See note on page 170.

U.D. No. 1, *Chadderton U.D. No. 2, *Church U.D. No. 1, *Corby U.D. No. 1, *Coventry C.B. Nos 1 and 2, Deptford M.B. No. 2, Ealing B. No. 4, Edmonton B. No. 3, *Ellesmere Port Nos. 2 and 3, Finchley B. Nos. 1 to 4, *Grantham B. Nos. 1 and 2, Halifax C.B. Nos. 3, Harrow B. No. 1, *Heckmondwike U.D. No. 1, *Huyton-with-Roby U.D. No. 1, Kensington M.B. No. 4, *Leamington Spa B. Nos. 5 to 8, Leeds C.B. Nos. 4 and 5, Leicester C.B. Nos. 4 and 5, Lewisham M.B. Nos. 6 and 7, Long Eaton U.D. No. 1, *Mirfield U.D. No. 1, *Padiham U.D. No. 1, Runcorn U.D. No. 1, Sedgley U.D. No. 2, Sheffield C.B. No. 5, Smethwick C.B. No. 3, Southport C.B. No. 1, Stoke Newington M.B. No. 5, Woolwich M.B. Nos. 7 and 8.

**New Orders Submitted for Confirmation but not yet Confirmed**

Acton B. No. 4, Aireborough U.D. No. 6, Barking B. No. 1, Barnet U.D. No. 2, Batley B. No. 1, Battersea M.B. No. 2, Beeston and Stapleford U.D. No. 1, Bermondsey M.B. No. 3, Bethnal Green M.B. No. 2, Bingley U.D. Nos. 1 and 2, Birmingham C.B. Nos. 11 to 20, Brentford and Chiswick B. No. 2, Bromley B. No. 3, Bury C.B. No. 2, Cheedle and Gatley U.D. No. 1, Cheltenham B. No. 1, Cheshunt U.D. No. 1, Chesterfield B. No. 2, Croydon C.B. No. 3, Dukinfield B. No. 1, Ealing B. No. 5, East Barnet U.D. No. 2, Eccles B. No. 1, Feltham U.D. No. 1, Finchley B. No. 5, Fulham M.B. No. 4, Hackney M.B. No. 3, Halesowen B. Nos. 1 and 2, Hampstead M.B. No. 3, Hayes and Harlington U.D. Nos. 9 and 15, Heywood B. No. 2, High Wycombe B. No. 9, Lancaster B. No. 1, Liverpool C.B. No. 12, Manchester C.B. No. 3, Mirfield U.D. Nos. 2 and 3, Morley B. Nos. 1 to 7, Newburn U.D. Nos. 1 and 2, Northfleet U.D. No. 1, Prescot U.D. No. 1, Radcliffe B. No. 1, Richmond (Surrey) B. No. 2, St. Pancras M.B. No. 3, Sale B. No. 2, Salford C.B. No. 1, Sheffield C.B. No. 7, Shoreditch M.B. No. 2, Stepney M.B. No. 2, Stockport C.B. No. 3, Stoke Newington M.B. No. 10, Stoke-on-Trent C.B. Nos. 1 to 6, Sunderland C.B. Nos. 2 and 4, Swinton and Pendlebury B. No. 2, Wallasey C.B. No. 6, Wandsworth M.B. No. 3, Wanstead and Woodford B. No. 2, Warrington C.B. Nos. 3 and 4, Wembley B. No. 1, Westminster M.B. Nos. 4 and 5, Whitefield U.D. No. 2, Wood Green B. No. 3, Woolwich M.B. Nos. 10 and 11, Worsley U.D. No. 2.

**Proposals Notified to the Minister**

Acton B. No. 5, Aldridge U.D. Nos. 7 to 10, Barnes B. No. 2, Barnet U.D. No. 3, Barnsley C.B. No. 3, Birmingham C.B. No. 8, and 21 to 33, Bredbury and Romiley U.D. No. 2, Burnley C.B. No. 2, Chatham B. Nos. 1 to 6, Cheadle and Gatley U.D. Nos. 2 and 3, Chelsea M.B. No. 2, Chislehurst and Sidcup U.D. No. 1, Colne B. No. 1, Dagenham B. No. 3, Doncaster C.B. No. 6, Ealing B. No. 6, Edmonton B. No. 4, Gateshead C.B. No. 3, Greenwich M.B. No. 2, Hackney M.B. No. 4, Hampstead B. No. 4, Hayes and Harlington U.D. No. 16, Hindley U.D. No. 1, Huddersfield C.B. No. 3, Hyde B. Nos. 2 and 3, Islington M.B. No. 4, Kirkby U.D. Nos. 1 to 4, Leamington Spa B. No. 11, Liverpool C.B. No. 13, Malden and Coombe B. No. 1, Merton and Morden U.D. No. 1, Morley B. Nos. 8 and 9, Mossley B. No. 1, Ossett B. No. 2, Pudsey B. No. 1, Sheffield C.B. No. 8, Slough B. Nos. 4 and 5, Southall B. No. 3, Southgate B. No. 2, Smethwick C.B. No. 4, Stockport C.B. No. 4, Stoke Newington M.B. No. 6, Tottenham B. No. 3, Twickenham B. No. 1, Wakefield C.B. No. 3, Wallsend B. No. 1, Wanstead and Woodford B. No. 3, Wembley B. Nos. 2 to 5, West Bromwich C.B. No. 9, West Ham C.B. No. 2, Westhoughton U.D. No. 1, Whitefield U.D. No. 3, Willenhall U.D. No. 11, Wolverhampton C.B. Nos. 2 and 3, Wrexham B. No. 1.

## SCOTLAND

**New Smoke Control Areas in Operation**

Clydebank No. 1, Edinburgh No. 2, Glasgow Nos. 2 to 4.

**New Orders Confirmed but not yet in Operation**

Lanark County No. 1.

**New Orders Submitted for Confirmation but not yet Confirmed**

Nil.

**Proposal Notified to the Minister**

Clydebank No. 2.

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**Hard Coke.** The British Coking Industry Association (74 Grosvenor St., London, W.1) have issued a useful folder containing a number of Information Sheets. They deal with hard coke uses and equipment, covering small bore central heating, automatic and sectional boilers, for hotels, etc., for the nurseryman, and for large scale central heating.

# *Home Comfort —by Gas*

Top marks to the "Comfort in the Home" Exhibition, sponsored by the Eastern, North Thames, South Eastern and Southern Gas Boards, at the Royal Horticultural Hall, London, which was held from February 7th to 18th last. It was arranged on really practical, informative lines, and covered the whole field of modern domestic gas heating methods. Well-designed and displayed, the exhibition was pleasing because the stands were not vieing with, but were complementing, each other. They were devoted to the different functions of gas in the home, the manufacturers of appliances and equipment being represented simply by the appropriate examples of their products.






*Two general views of the Exhibition*

There was a wide range of modern equipment, actually working, of gas heating systems suitable for both new and existing houses. Three important forms of heating demonstrated were central heating by hot water—both combined and separate heating and hot water systems; whole house or selective warm air, again showing both combined and separate systems; and the convector-radiant room-heater for living room heating. The latest advances in cookers, automatic controls, flues, insulation and ducting, were also shown.

An interesting development shown in the research and development section was an almost enclosed, glass-fronted gas room heater, for which a heating efficiency of 75 per cent. is obtainable.

Property modernization, gas heating and modern flue systems in flats and maisonettes, and research and development, were other sections of considerable interest. We would like to see more exhibitions of this nature and quality.

# THE CLEAN AIR AND THE IRONFOUNDRY

by

**A. ARCHER**

*Chief Public Health Inspector, Halesowen*

IN this paper, read at a meeting of the West Midlands Division of the Society on 17th November, 1960, Mr. Archer has examined the problem of the emission of grit, dust, smoke and fumes from ironfoundries in the United Kingdom. Many of the ironfounders are concentrated in the Midlands and other industrial areas, and in the aggregate they present a problem from the point of view of industrial air pollution. Because the industry is potentially a dusty one and because some of these are dangerous to health, a great deal of work has been done to remove harmful dusts and fumes from the immediate vicinity of the operator. This is the concern of the factory inspectorate but it is important from the point of view of the community at large to see that these air pollutants are not emitted into the outside air but that they should be carefully extracted and filtered by suitable apparatus.

Mr. Archer calls attention to the recommendations of the Committee on Air Pollution—The Beaver Committee—which said that air pollution on the scale of which we are familiar in this country is a social and economic evil which should no longer be tolerated and it needs to be combated with the same conviction and energy as we applied one hundred years ago in securing pure water.

He claims that local authorities are not implementing the Clean Air Act so far as the industrial provisions are concerned as vigorously as they ought to do. They are concentrating their energies in dealing with the domestic problem which is admittedly a serious one. The Clean Air Act has changed the whole approach to the problem of dealing with air pollution in that before it was passed local authorities could not take action until they became aware of conditions which were a nuisance to the inhabitants or prejudicial to health. They now have a positive duty to secure clean air by implementing the various provisions of the Clean Air Act relating to the prevention of dark smoke and minimising the emission of grit and dust.

The author makes the suggestion that with regard to the ironfounding industry a technical committee should be formed consisting of representatives of the industry, public health inspectors, and factory inspectors, to examine the various air pollution problems and to make recommendations both to industry and to local authorities. He suggests that a time limit should be laid down within which the industry is required to comply with the various provisions of the Act and within which local authorities would expect to control the various problems. In this way he suggests that progress will be made much more rapidly in dealing with this particular form of industrial air pollution. Moreover, the ironfounder will have the satisfaction of knowing that in each local authority area he will be required to comply with the Act in the same way under similar circumstances.

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The technical descriptions of the sources of pollution in the industry, as given by Mr. Archer, are reproduced in full from his paper, as follows:

**Foundry Operations**

The number of ironfoundries in the United Kingdom is said to be about 1,800, and some 250 of these are concentrated in the area covered by the

counties of Shropshire, Staffordshire, Warwickshire and Worcestershire. These foundries differ greatly in size and method of production and they may produce castings ranging from a few ounces to several tons. Whilst some foundries, especially ones built in recent years, may be highly mechanized many of the smaller jobbing foundries are carried on in obsolete buildings and using methods which have varied little over the last fifty years.

For those who are not familiar with the operations in ironfoundries, it may be as well to describe briefly how castings are usually made:

(*a*) a pattern is constructed either in wood or metal,

(*b*) a metal frame is placed over the pattern and sand is rammed round it; two or more box parts with a parting line between them may be required, and the pattern is removed by separating the mould into sections at the parting line or lines. The shape of the pattern is left in the moulding sand,

(*c*) sand cores which are made separately are placed in the mould to form internal cavities where these are required,

(*d*) the sections of the mould are put together and the molten metal is poured in. When the casting is solid it is removed by knocking out, *i.e.* the casting is separated from the sand and the metal box parts in which the mould was made,

(*e*) the rough casting is fettled and dressed by removing excess metal, adherent sand, and so on.

Many of these operations produce dust, grit or fume, and it is proposed to examine some of them in greater detail to see how far the operations are related to possible air pollution outside the foundry.

**Pattern Making**

The refuse is normally wood waste and poses no special problem.

**Core Making**

A special type of sand is mixed with a binder consisting of linseed oil, mineral oil, dextrin, or phenolic resins. The core sand mixture is moulded into the required shape in core boxes and the green cores baked in ovens. Alternatively, the cores may be made by subjecting sand mixed with sodium silicate to the effects of carbon dioxide, whilst in a third method shell cores are made in an automatic machine. Most of the binders give off odours on heating, some of which are visible and some lachrymatory.

**Metal Pouring**

The pouring of molten metal into a sand mould results in the emission of fume due to the combustion of coal dust or pitch, these substances being mixed with the sand to prevent defects in the casting. In addition fume is given off from the cores in the mould because of the effect of the heat on the core binders used. When the metal is first poured the fumes catch fire and burn but eventually they cool to a temperature below that required to sustain combustion and the mould then continues to fume. In a mechanized foundry as much of the fume as possible may be collected in a cooling tunnel over the conveyor and extracted to the outside air. In non-mechanized foundries where pouring takes place all over the floor, the fume enters into the general foundry atmosphere and percolates from the foundry at any ventilating points there may be.

**The Knock-out**

When the casting has solidified it has to be removed from the mould and the box in which the sand and casting are contained. In the course of this operation quantities of dust and fume are evolved almost continuously in close proximity to the working positions. If they are not to pollute the foundry atmosphere they must be dealt with by applying adequate local exhaust ventilation at the knock-out point or points, and in mechanized foundries it is usual for the knock-out

to be concentrated in one or more permanent positions.

In many jobbing, heavy and light foundries where pouring takes place all over the floor, knocking out is similarly done in different places on the foundry floor. The prevention of dust and fumes in this case is very difficult.

### Casting Cleaning

After the castings have been removed from the mould they still have some sand adhering to them, and this has to be removed for the production of a reasonably clean and smooth surface. The methods used depend entirely on the weight, the size and the nature of the castings, and may involve the use of different types of apparatus and appliance including shot blasters, wire brushes, rumbling barrels and grinding wheels. With most shot blasting units dust removal and collection is an inherent part of the unit and the filter portion is usually made of fabric.

### Fettling and Dressing

To remove surplus metal from the castings before machining, it is usual to use hand or pneumatic chisels, portable hand grinders, swing frame grinders or pedestal grinders, depending on the size and type of casting. Work carried out in recent years on this type of equipment has shown that a considerable amount of dust suppression is possible. The collected dust can be trapped by using fabric or wet collectors.

### Annealing

Some special types of cast iron have to be subjected to a long heat treatment process to make them soft and ductile, and this process is known as annealing or malleabilizing. The castings after cleaning and dressing are packed in pots and stacked in furnaces which may be fired by gas, electricity, coal or pulverized fuel. The furnace has to be brought up to the requisite temperature and this may take from 12 to 36 hours; the temperature has then to be held steady for perhaps four or five days.

A recent questionnaire showed that there are approximately 100 firms doing malleabilizing, the majority of which are in the South Staffordshire area; 34 per cent. of the ovens are fired by oil, 12 per cent. by coal gas, 20 per cent. by lump coal, 25 per cent. by pulverized fuel and 9 per cent. are electric. Approximately 45 per cent. of malleable iron foundries therefore use bituminous fuel and in many cases find it difficult to avoid contravening the Clean Air Act in respect of dark smoke emissions. Technically there is no reason why oil should not be used for firing an annealing furnace or why in some cases conversion to electricity should not be carried out. The deciding factor will often be one of expense.

### Melting Furnaces

Several types of melting furnaces are found in iron foundries but the commonest type is the cupola which melts more than 90 per cent. of the industry's requirements of molten metal. Other furnaces met with are the hot blast cupola, air furnaces using oil and pulverized fuel, rotary furnaces using oil and pulverized fuel, and electric furnaces which may be induction or direct arc type. The cupola is widely used because it is simple in operation, has a low capital cost and high thermal efficiency. As the hot blast cupola is the responsibility of the Alkali Inspectorate it is not proposed to discuss the special problems associated with it.

### The Cupola Furnace

The problem of emissions of dust, grit and gases from the cupola furnace has been extensively studied by the British Cast Iron Research Association and three reports by F. M. Shaw are of special interest. He makes the following contentions:

(1) grit and dust emitted from a cupola can be reduced by avoiding the use of dust bearing materials in the cupola charge,

(2) fume is inseparable from the use of steel scrap and at present no

method is known of preventing fume formation,

(3) dirty scrap can be burnt in the cupola stack if the right conditions are maintained,

(4) oily wastes and so on can cause considerable smoke if used to kindle bed coke; oil or gas burners should be used,

(5) a simple spray and baffle type collector will remove about half of the dust in the stack gases and about one-third of the sulphur-oxides.

He has concluded that the most popular type of expansion chamber and baffle is very inefficient and collects only the heaviest particles, and that to obtain collection efficiencies of over 70 per cent. by weight fairly expensive equipment is needed. For efficiencies over 90 per cent very elaborate and expensive collectors must be used, *i.e.* electrostatic precipitators or bag filters. The simple baffle and water spray type of collector will remove about half the dust in the stack gases and offers the cheapest means of achieving a reasonable degree of cleaning.

**Summary of the problem**

Some foundry processes are responsible for the production of large amounts of dust, grit, fumes and smoke. The processes chiefly concerned are melting processes when cupolas are used, the making and drying of cores, the knock-out and dressing operations. A great deal of work has been done and continues to be done to find means of eliminating or suppressing dust in foundries in the interests of the workers and of production. Nevertheless, many problems are still to be solved and until they are, many foundries, especially the older type, will be responsible for the emission of a variety of air pollutants to the detriment of the inhabitants who live nearby. Indeed even where conditions are relatively good inside the foundry there is still a likelihood that conditions outside may be poor unless very great care is exercised to see that dust and fume collecting equipment is properly handled and maintained. It is important therefore to relate the conditions and the problems inside the foundry to the conditions outside.

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# *The Headquarters Fund Appeal*

Donations to the Fund still continue to be received, and we have pleasure in acknowledging the following:

**50 guineas.**—West Midlands Gas Board.

**£25.**—Gibbons Bros. Ltd.

**15 guineas.**—Leicester Corporation.

**£15.**—South Wales Electricity Board.

**12 guineas.**—Barking Corporation.

**10 guineas.**—Blackpool Corporation; Association of Public Health Inspectors.

**9 guineas.**—City of Durban, S.A.

**8 guineas.**—Brierley Hill U.D.C.

**6 guineas.**—Stepney Corporation.

**5 guineas.**—Wednesfield U.D.C.

**4 guineas.**—Dewsbury Corporation; St. Marylebone Corporation; Wimbledon Corporation; Lincoln Corporation; Epsom and Ewell Corporation; Eton R.D.C.

**3 guineas.** — Shoreditch Corporation; Macclesfield Corporation; Hyde Corporation; Horsforth U.D.C.; Felling U.D.C.; Feltham U.D.C.; Beddington and Wallington Corporation; Dartford Corporation; Finchley Corporation.

**£2 14s.**—Chadderton U.D.C.

**2½ guineas.**—Elstree R.D.C.; Rothwell U.D.C.; Horbury U.D.C.; Crompton U.D.C.; Hitchin U.D.C.; Hindley U.D.C.

**£2 10s.**—Glossop Corporation.

**2 guineas.**—Professor F. E. Tylecote; Eastwood U.D.C.; Tottenham Corporation.

**1 guinea.**—Leatherhead U.D.C.; Southgate Corporation.

**£1.**—Mrs. M. E. Willison.

**Total to date: £4,359 14s. 6d.**

# W.H.O. REPORT ON AIR POLLUTION

**Air Pollution. Monograph Series, No. 46. World Health Organization, Geneva, pp. 442. Cloth-bound, £2 or $8.00.**

This well-produced volume is the result of a meeting of the W.H.O. Expert Committee on Environmental Sanitation in 1957. It consists of fourteen contributions, by individual experts, on the main aspects of the problem. The purpose and keynote to the work is indicated in the introduction, in which it is stated:

> " The control of air pollution is no longer concerned merely with the products of simple combustion of conventional fuels. Industrial effluents discharged into the atmosphere are increasing in amount, in diversity and in complexity. As a consequence of developing industrialization, of the expanding use of internal combustion engines, and of the greater densities of population exposed to air pollutants, the seriousness of the situation is rapidly increasing, and the difficulties of applying effective controls are becoming progressively greater.
>
> " This monograph brings together a body of recent information on a number of aspects of air pollution for the benefit of public officials, and in particular public health officials, who are faced with the necessity of taking appropriate and effective action. . ."

The scope of the book can best be shown by listing the subjects dealt with, and their authors, as follows:

Historical review, by E. C. Halliday (S. Africa); identification of the problem, by Louis C. McCabe (U.S.A.); the role of meteorology by Harry Wexler (U.S.A.); sampling, analysis and instrumentation, by F. Cambi (Italy); aspects of the physical and chemical nature of pollution, by Morris Katz (Canada); effects on human health, by Harry Heimann (U.S.A.); effects on animals, by E. J. Catcott (U.S.A.); effects on plants, by Moyer D. Thomas (U.S.A.); economic and social aspects, by E. Leclerc (Belgium); control by site selection and zoning, by J. R. Taylor, A. Hasewaga and Leslie A. Chambers (U.S.A.); prevention and control by process changes or equipment, by A. H. Rose, D. G. Stephan and R. L. Stenburg (U.S.A.); fuel selection and utilization, by K. Barker and W. A. Macfarlane (Gt. Britain); legislation, by Albert Parker (Gt. Britain) and radioactive pollution, by H. P. Jammet (France).

In a short notice it is impossible to attempt to evaluate the importance or other qualities of the different contributions, but considered individually they are comprehensive and detailed reviews of existing knowledge in their several fields, and considered together they constitute a most valuable reference manual. It is true that since the project was started four years ago there have been considerable advances and a widening of horizons in some sectors, but such a time-lag is perhaps inevitable when air pollution begins to be studied globally. It is a pity that what is probably the biggest concerted effort to deal with one of the most serious forms of pollution in any country, namely the prevention of domestic coal fire smoke in Britain by means of expanding smoke control areas, receives no mention other than a paragraph in Parker's review of legislation.

# IN MEMORIAM

**Fuel Research, 1917-1958. Published for the D.S.I.R. by H.M. Stationery Office, London., pp. 120. 15s. net. (U.S.A., $2.70).**

This history of the Fuel Research Board and the Fuel Research Station at East Greenwich is a fitting tribute to an enterprise that for forty years did a notable amount of research and development work on fuels and their uses, including valuable work on smoke, its measurement and its prevention.

It was in 1917 that the Department of Scientific and Industrial Research appointed a Fuel Research Board " to investigate in the broad national

interest the nature, preparation, utilization and treatment of coals and other fuels, and of products derived from fuels."

In the following year the Fuel Research Station was established at Greenwich. In 1958 the Research Council considered that, in view of many developments in the fuel world, the Station had completed its work and should be closed down. The volume just published summarizes the achievements of the Station in a way that is of practical value, in that it presents in concise form information that might otherwise be difficult to locate. There are, for example, 151 references to the published papers of the Station.

The main sections deal with basic aspects of fuel research, including fuel analysis, carbonization, preparation of coal for the market, gasification of coal and coke, coal constitution, combustion and steam raising, hydrogenation of coal and coal tar, the Fischer-Tropsch synthesis, air pollution and domestic heating. There is an important section on the coal survey laboratories.

The review has been edited by Dr. A. C. Monkhouse, formerly Deputy Director, and has a foreword by Sir Harold Hartley, who was for many years Chairman of the Board.

## COAL TAR FUELS

**Coal Tar Fuels, 2nd Edition. Association of Tar Distillers, 9 Harley St., London, W.1. One guinea.**

Coal tar fuels make an important contribution to the fuel resources of the country in these days of increased usage of liquid fuels. They are derived from British coals and have the advantage of a low sulphur content and high flame emissivity.

The authors of this new and wholly rewritten edition of the book are experts in the field of liquid fuels, especially of coal tar fuels, where they have been closely associated with developments in recent years. The book deals with production, composition and properties, and preparation of the fuels. Other chapters deal with combustion, storing and handling, and types of burners, pumps, valves, heaters and other auxiliary equipment. In the final chapter on " Applications " the suitability of coal tar fuels for open-hearth furnaces and other types of metallurgical plant, and for boiler plant and other purposes, is demonstrated.

## RADIATION

**The Hazard to Man of Nuclear and Allied Radiations. A Second Report to the Medical Research Council. H.M. Stationery Office, pp. 154. 7s. net.**

This second report is a comprehensive survey of the new problems and hazards due to radiation. It covers biological, genetic and general health aspects, existing and foreseeable levels of radiation, and assessment of the hazards of exposure. There are a number of appendices of importance, including one on the nuclear reactor accident at Windscale in 1957, concerning the environmental effects.

## SMOKELESS STOKER FOR CENTRAL HEATING

*A New Design of Fully Automatic Smokeless Stoker*, by S. A. Burke, K. E. Collins and R. G. S. Johnston, is the title of a paper reprinted from the *Journal of the Institution of Heating and Ventilation Engineers* for the British Coal Utilization Research Association. The paper describes the work done at B.C.U.R.A. on the production of a smokeless chain-grate stoker for coal, suitable for central heating installations. It will be recalled that the paper to the N.S.C.A. conference at Llandudno, 1958, discussed this stoker, and the present paper is a more detailed technical account, with information on the automatic controls that have been developed and patented.

# An Early Estimate of Pollution Costs

We are indebted to Mr. G. H. Cooper, Chief Public Health Inspector, for an interesting extract from a book published in Ashton-under-Lyne in 1844 with the impressive title of *A Report on the Sanitary Condition of the Town of Ashton-under-Lyne; with Remarks on the Existing Evils, and Suggestions for Improving the Health, Comfort and Longevity of the Inhabitants.* The author, a John Ross Coulthart, Esq., has submitted this report to Dr. Lyon Playfair, " one of Her Majesty's Commissioners for Enquiring into the State of Large Towns and Populous Districts."

On page 47, under the heading " Consuming Smoke," the author expresses " the desirableness of having the smoke of our chimneys consumed, and the atmosphere relieved from the dense volumes of soot and small coal that, six days out of seven, issue from our tall chimneys."

" There can be no doubt," he says, " that smoke is detrimental to health, and that the mean average duration of the lives of the inhabitants of the town is materially affected by it. The visible and palpable ruin which it effects, of all trees, shrubs, and plants within its influence, indicates portentiously its powerful agency in the destruction of organic matters. But, apart from physiological considerations, which I am neither qualified nor inclined to enter upon, I would merely observe the injurious effects of a sooty and smoky atmosphere to the gentry, and to the linen drapers, silk mercers, haberdashers, and other shopkeepers of the town are very great, and a serious tax upon their incomes, though the actual loss cannot be easily estimated."

However, Mr. Coulthart makes an attempt, and produces what may well be the first of many attempts to evaluate the monetary cost of smoke. Taking what he believes is an " exceedingly low principle " he states:

" Assuming that every person in the town spends on the average 2d. per week in washing, and that one-fourth of that sum is occasioned by smoke and soot from the factory chimneys, which might be avoided, it follows that the annual loss to the town is .. .. £2,459 3s. 4d.

" Assuming also that every shop in the town costs on the average £5 per annum for painting, and that one-fourth of that sum is occasioned by smoke and soot that might be consumed, it follows that 387 shops, at £1 5s. per shop, gives an annual loss in that item of £483 15s. 0d.

" Annual loss in washing and painting .. £2,942 18s. 4d."

And this isn't just guesswork, emphasizes the author—or to put it in his own words, " although the computation is necessarily hypothetical, yet the premises have not been assumed hastily, but after the annual expenses of domestic washing and shop painting in several agricultural towns had been compared with those usually incurred in Ashton-under Lyne."

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**Clean Air in the Interest of All**

Clean air is in the interest of all and miners realize just as much as anyone else that smokeless zones are a thing of the immediate future—Mr. Sam Bullough, president of the Yorkshire Area of the National Union of Mineworkers.

**Stretford tries to stop the Rot**

Atmospheric pollution has been rotting Stretford's concrete lamp posts, and the Council has decided to carry out a five-year experiment on a new type of post to try to " stop the rot."

Mr. Arthur Perry, Stretford's surveyor, has explained that the trouble is due to the nearby industrial area of Trafford Park, Manchester. As a result there was a certain amount of sulphur and acidity in the air which had an effect on the lamp posts.

# TECHNICAL NEWS

## GAS RESEARCH

The Gas Council is establishing a new basic research group of scientists who will be expected to develop entirely new ideas for the production and utilization of gas. They are seeking a leader who will originate and pursue long-term research projects which will make a radical contribution to the future progress and prosperity of the industry. The group will investigate any new aspects of scientific discovery which might lead to the development of new processes for gas manufacture, distribution and use.

## A CARBON MONOXIDE DETECTOR

Combustion Instruments Ltd. (61 Belsize Lane, N.W.3) have introduced a new CO detector that is based on a simple and rapid method developed during the war. The test is effected by drawing a sample of air through an accurately dimensioned glass tube containing a column of yellow palladized silica gel, on each side of which is a column of white gel to act as a filter to remove interfering gases. On passage of CO through the tube, a dark stain is caused; a tubular scale on transparent plastic can be slipped over the tube to measure the length of the stain, from which the CO percentage is deduced by reference to calibration tables.

## EXCESS DIESEL FUEL STOP

The Ministry of Transport (see our last issue, p. 106) is considering a regulation to prevent the use, while the engine is running, of an excess fuel device that may be fitted to diesel engines. Excess fuel may be required to start the engine, especially in cold weather, but should not afterwards be used. It is, however, frequently used or " fiddled " with to give extra power and this is a common cause of dark smoke from diesels. One such excess fuel device, incorporating automatic stopping, is on the market and is manufactured by Simms Motor Units (Oak Lane, Finchley, London, N.2). It may be fitted to the firm's fuel injection pump and various models are available. The device permits the amount of fuel to be increased by some 50 per cent. above the normal maximum delivered from the pump, when the engine is being started from cold. As soon as the vehicle is mobile, however, it automatically adjusts the mixture to that suitable for ordinary driving, and it is so designed that this mixture cannot be altered while the vehicle is running.

## SMOKE-FREE BACON SMOKING

A new bacon smoking unit of Kinloch (Provision Merchants) Ltd. at Burgh Heath, Surrey, in a residential area, has been equipped with a Holmes-Catalytic Process, the principle of which is illustrated in the adjoining diagram. It makes it possible for the effluent to be discharged free from colour and odour.

The heart of the process is an all-metal catalyst unit containing metals of the platinum group. The catalyst promotes combustion at a temperature well below that required for direct incineration, and produces the usual products of combustion. The smoke is pre-heated to the catalytic ignition temperature by direct heating with an oil-burner; to conserve fuel the treated gases are passed through a heat exchanger to pre-heat the incoming smoke. A circulating fan is installed to draw smoke from the oven and to pass it through the process. The plant is fully instrumented to reduce supervision to a minimum, and in practice this is only required for a small part of the smoking operation which normally takes 36 hours.

Since the operation began it has been found that in addition to doing its main job of treating the fumes, a number of other advantages have resulted, including a more even smoking of the bacon and a reduced

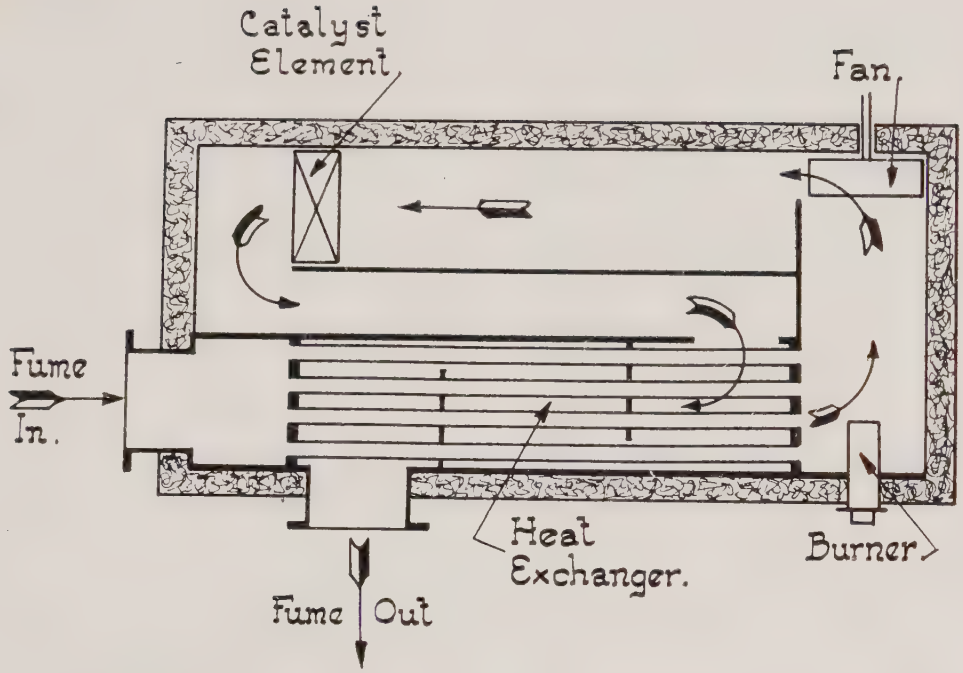



*Diagram showing the Holmes-Catalytic Process, as applied to the Bacon-curing Unit*

consumption of the sawdust fuel. The process, in general terms, is described in a brochure, Publication No. 70, obtainable from W. C. Holmes & Co. Ltd., P.O. Box B7, Turnbridge, Huddersfield.

## NEW LIME KILN

Lime burning has always been one of the more difficult industrial process to render free from smoke and dust, and there is therefore much interest in a new kiln which in addition to other technical and economic advantages, is claimed to be operable without any smoke emission. It employs the " Catagas " system of lime-burning using oil gas in which the entire combustion takes place *inside the kiln* without using internal burners. This is a completely new system and should not be confused with conventional oil-burning systems where combustion takes place in a combustion chamber and the heat has to be transferred by some means to the charge, or by using a centre burner within the kiln.

An installation is expected to be in operation shortly, and we hope to be able to report on and illustrate this in greater detail in an early issue.

## GRAPHITE-GLASS ELECTRIC HEATING

A new form of electric heating has recently been developed. It consists of a fine-woven fabric of glass fibre, the filaments of which—about 120 in each strand of the fibre—are coated with pure graphite. The sheet consists in effect of many thousand microscopically fine conductors in parallel. The fabric is bonded with a suitable resin to protect the graphite and the finished " mat " is thin, light in weight and flexible.

Known as Mhoglas, the element produces the same amount of heat per

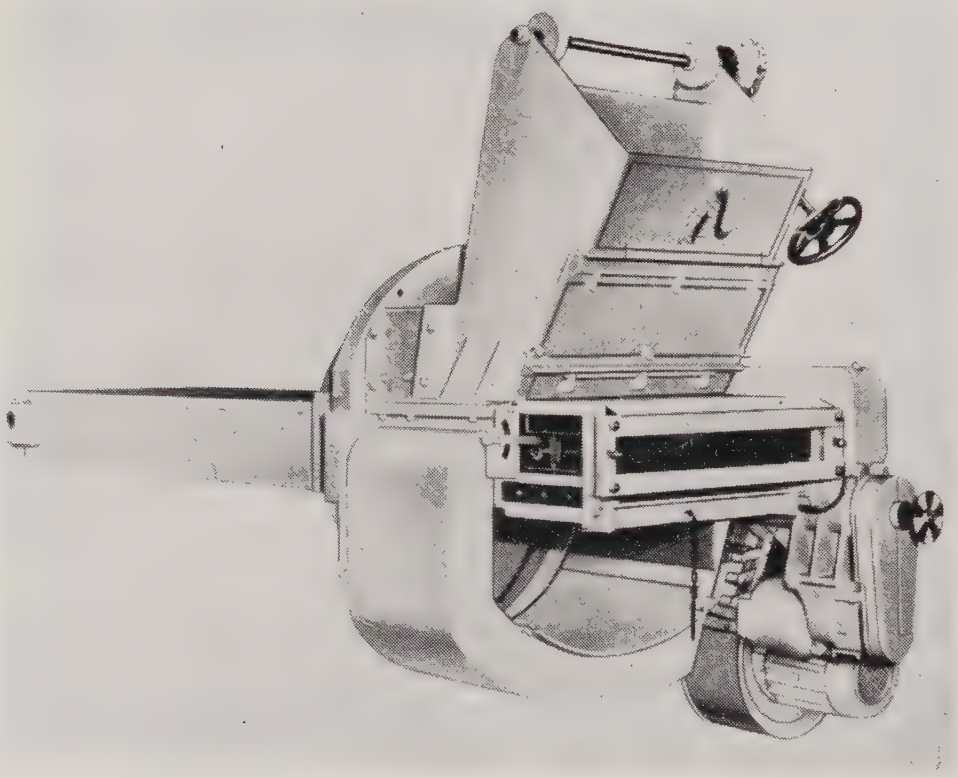


*A Mhoglas wall unit installed in a living room*

kilowatt as a metallic element, but it is diffused over an area about 150 times as large, producing a very much lower temperature at any one point, without in any way affecting the total heat output. The domestic heating panels run at temperatures of not more than 160°F. (71°C.), at which they can safely be touched, and at which fire risk is nil.

For the heating of living and other rooms the panels can be used in the form of free-standing portable heaters, mounted on walls, or included in the wall treatment of new buildings. Other uses include a table hot-plate.

More information may be obtained from the two firms manufacturing Mhoglas elements—Hunting Mhoglas Ltd., Skimpot, Luton, Beds., and Morheat Ltd., Church Path, Fareham, Hants.



*The new Hodgkinson Mark IV Chain Grate Stoker*

## NEW CHAIN GRATE STOKER

We illustrate the new Mark IV Chain Grate Stoker introduced by the Hodgkinson Group—James Hodgkinson (Salford) Ltd. and Bennis Combustion Ltd.—who say that "the accumulated experience of both companies over a number of years has been combined in this development and its many design features make it the foremost stoker of its type to be manufactured."

The grate has been completely redesigned—there are now three patterns of links—giving full self-cleaning action and clearer air spaces for improved cooling and more effective distribution of primary air resulting in better combustion and higher output.

Link rods are shouldered for positive tightening without restricting link movement and there is full diameter penetration of the side links. A positive and almost friction-free drive is obtained with redesigned front sprockets bearing on all driving links through rollers incorporated in the grate, and the new rear drum, which supports the full width of the grate.

# AIR POLLUTION ABSTRACTS

**486. Control of Inversion Height by Surface Heating.** Gualle, F. K. (Q. J.R. Met. Soc. **86,** October, 1960, 483-494). Viscous dissipation is inadequate to account for the destruction of all the thermal turbulants generated by upward transfer of heat in a deep convection layer. It is suggested that the surface turbulant kinetic energy is destroyed by buoyancy forces in a region of downward transfer of heat in the upper part of the convection layer. This process is associated with mass transfer downwards through the convection (or subsidence) inversion and also with an upward movement of the inversion, though the latter may be overcome by sufficiently strong subsidence. A simple theory of the process is developed and the results deduced thereby agree well with observations of the diurnal variation of inversion height in Central Australia. (Author's Abstract).

**487. Practical Design Aspects.** Sayers, K. E. (J. Inst. Fuel, **33,** November, 1960, 542-550). The Paper considers the various design factors and operating conditions which have a major influence on the performance of an electro-precipitator installation. Emphasis is placed on the importance of the detailed design and layout of the discharge and collecting electrode systems and of the necessity for efficient cleaning of the electrodes and effective dust disposal arrangements. Reference is made to the effects of the electrical characteristics of the dust and the carrying gas, and to the desirability of pre-treatment of the dusty gas stream to maintain controlled conditions of temperature and humidity in certain cases. The application of these principles to the design of precipitator installations for power stations and for a number of steel works duties is then considered, with brief descriptions and illustrations of typical installation arrangements in these fields. The Paper concludes with a reference to the difficulties in the way of forecasting, with any degree of accuracy, the conditions under which a new precipitator installation will have to work and stresses the necessity for a cautious design approach and maximum collaboration between manufacturers and users, particularly on new or novel applications, to insure the best prospects of successful operation. (Author's Abstract).

**488. Air Pollution and Respiratory Diseases.** Laidlaw, A. J. (Public Health, **75,** October, November, 1960, 25-30). The Paper draws attention to the overwhelming incidence of respiratory disease in this country compared with other countries. Various definitions of air pollution and respiratory disease are discussed and also the relationship between air pollution and respiratory disease. Methods of assessing the effects of pollutants on patients by examining mortality, sickness records or total morbidity, are considered. Some of the results of a survey of Morbidity in General Practice are given.

**489. Methods for the Analysis and Testing of Coal and Coke: British Standard 1016: Revised 1957-60.** King, J. G. (J. Inst. Fuel, **33,** November, 1960, 550-552). The revised British Standard is described. In the new standard all the preparation of the samples has been omitted and is given in B.S. 1017, and B.S. 1016 deals solely with methods of analysis. The new standard is being published in sixteen parts which are listed in the Paper. It is pointed out that a special feature is made of part 16 of the standard in which all definitions have been brought together and a list of tolerances is given by which any laboratory should find it possible to duplicate analyses. The differences from the 1942 standard are described.

**490. Air Pollution Review 1958-59.** Faith, W. L. (Ind. Eng. Chem., **52,** November, 1960, 967-71). This review includes articles in which a specific application to air pollution is made. The literature dealing with concentration and determination of specific pollutants has increased: greater emphasis has been given to automobile exhausts, with the State of California adopting standards for emissions of CO and hydrocarbons: presence of radioactive materials in the atmosphere and in industrial wastes is covered: training courses and manuals for pollution control and abatement personnel are discussed. Bibliography. (APCA).

**491. Waste Disposal Without Air Pollution.** Compton, C. R. and Bowerman, F. R. (J. Air Poll. Control Assoc., **10,** February, 1960, 57-9, 95). Examples

of wastes disposal procedures which use the atmosphere for disposal are in the burning of combustible materials either in or outside of incinerators, and in the storage by open ponding of petrochemical wastes, with resulting evaporative losses. Waste disposal may in almost all instances be consummated without placing an undue burden on the atmosphere: however, the accomplishment of that results from careful planning. Air Pollution Control Officers may hasten the education process by serving as catalysts between the needs of the waste producer and the designer and operator of the waste disposal facility. Refuse disposal, incineration, sanitary land filling, disposal of industrial wastes; liquid industrial wastes, and solid industrial wastes are discussed in detail.

**492. Studies in High-Temperature Gas Cleaning. The Reduction of Fumes From Open-Hearth Furnaces.** Strauss, W. and Thring, M. W. (J. Iron Steel Inst., **196,** September, 1960, 62-5). Various methods for dealing with the orange or brown fume produced by oxygen lancing have been investigated: electrostatic precipitators, bag filters, and multi-cyclones followed by venturi scrubbers have proved successful in individual cases. Economic considerations which govern the choice of a suitable method for each case either quantities of dirty gas to be handled, the degree of cleaning required, the rate of gas production, an adequate water supply, and the space available for the erection of a gas cleaning plant. Experiments in filtering waste gases from open-hearth furnaces at temperatures of 375°C., using a course granular filter medium, colder than the gases to give thermal precipitation, gave efficiencies better than 90 per cent. under many operating conditions and pressure drops varying between two and four inches water gauge, for a nine inch thick bed. Beds of 1, 3, and $10\frac{1}{2}$ inches were also investigated under a wide range of operating conditions. Ceramic filters and crushed refractory beds were also tested. (APCA).

**493. A Field Method for the Determination of Sulphur Dioxide in Air.** Hands, G. C. and Bartlett, A. F. F. (Analyst, **85,** February, 1960, 147-8). Strips of filter paper are impregnated with an ammoniacal solution of zinc nitro prusside, dried at a temperature not exceeding 40°C. and stored in the dark. The paper is moistened with water by means of an insufflator and fixed in the holder. A 360 ml. sample of air is drawn through the paper at a rate not more than 6 ml./sec., and the brick-red stain produced if $SO_2$ is present is compared with the standard stain chart or with a disc of standard tints in order to determine concentration of the gas. A series of five colours, representing 1-20 vbm. of $SO_2$ in the 360 ml. sample, was found to be adequate. (APCA).

**494. Air Pollution and Respiratory Disease. A Preliminary Report.** Dohan, F. C. and Taylor, E. W. (Amer. J. Med. Sci., **240,** September, 1960, 337-9). A detailed study of the epidemiological data from the insurance and personnel statistics of a large multi-plant electronics company, indicated large and consistent differences in the annual incidence of respiratory diseases among the women employees in eight ecologically different cities. Data for the insurance years (October 1st to September 30th of the indicated year) of 1955, 1957, and 1958 were available. When these figures for five of the cities were studied in relation to the air pollutant (sulphates) level in the same cities, a high correlation was found. The average annual incidences of the three respiratory diagnostic sub-categories of bronchitis, influenza, and miscellaneous (virus infection, upper respiratory infection, sore throat, and others) were also correlated with average sulphate concentrations. The incidence of pneumonia did not vary greatly. The findings of the current study, in association with other information, suggests that susceptibility to, or duration of, some common respiratory infections is increased by exposure to air pollutants measured as sulphates. (APCA).

**495. A Tracer Technique to Measure Deposition of Stack Emission.** Schulz, E. J., et al. (Amer. Ind. Hyg. Assoc. J., **21,** October, 1960, 343-9). The investigation indicates that this tracer technique is a useful tool in the quantitative measurement of the particulate deposition rate of industrial emission. The variable depositions of uranine solutions exposed to the atmosphere in dust fall containers prevents the use of dust fall jars as sampling devices. Based on laboratory study, uranine can be dispersed as a tracer into stack at stack-gas temperatures up to 600°F. without decomposition. With direct stack injection, losses of tracer in the stack must be determined for each

application. In using uranine it is mandatory that background fluorescence be determined in the area to be investigated. However, the technique is not limited to uramine. Any soluble material that satisfies the requirements of a tracer can be employed with this method. (APCA).

**496. Atmospheric Pollution with Reference to Plants.** Baldacci, E. and Ceccareeli, V. (In Italian). (Chem. E. Industr., **40,** April, 1958, 274-281: C. E. *Transl.* 1531: CEGB Dige., **12,** (25), 1960, 7). The effects of the most important polluting agents, namely sulphur dioxide, fluorine and its compounds, chlorine, hydrochloric acid, ammonia and nitrogen oxide, and smog, from the point of view of damage to plants are discussed. The relative sensitivities of various plants to these agents are tabulated.

**497. Method and Apparatus for Treating Exhaust Gases with an Exhaust Gas Burner with Catalytically Induced Flame.** Barkelew Manufacturing Company, and Clayton, W. (U.S.P. 2, 947, 600/1960: GA, October, 1960, **16,** 236). Method and apparatus for treating auto exhaust gases to attain their complete combustion is claimed in which catalytic oxidation is applied. The device consists of a cylindrical metal shell in which is supported centrally a front catalyst and a rear combustion chamber surrounding a central pilot burner tube.

**498. Measuring the Dust Content of Industrial Gases and of the Air Measurements of Dust on the Ground.** Guthmann, K. (BCIRA J., **8,** November, 1960, 883-903). The most important instruments for measuring dust are described and a report is given of experience in measuring dust contents of industrial gases and atmospheric air, of particle size determination in gases or air, and of new experience with apparatus for measuring deposited dust.

**499. The California Motor Vehicle Emission Standards.** Hass, G. C. (Paper to Soc. Automot. Engrs., August, 1960, 10 pages: MIRA mon. Summ., November, 1960, 5, 6). The Paper discusses the standards which were adopted in December, 1959, by the California Board of Public Health for air contaminants emitted in motor vehicles exhaust. For hydrocarbons, the standard is 275 ppm. by volume as hexane (0·165 mole. per cent. carbon atoms): for carbon monoxide, the figure is 1·5 per cent. by volume. The standards relate to a composite sample representing a driving cycle consisting of periods of idling, cruising at various speeds, and acceleration and deceleration to and from various speeds.

**500. Clean Air.** Joint Iron Council (London: The Council, June 30th, 1960, Annual Report, 15, 16). Measures for dealing with air pollution from hot-blast cupolas are given. These provide for the disposal of fumes by means of a chimney and the arrestment of grit and dust by a cyclone, or by a non-mechanical arrangement in the case of the smaller furnaces.

**501. Emission of Sulphur and Ash in Smoke from Thermal Power Stations.** United Nations, Economic Commission for Europe. (Geneva: The Commission, November, 1959, EP/W Working Paper. 174, 23 pp.: CEGB Digest **12,** (25), 1960, 7). This report relates only to power stations equipped with steam generators fired with pulverized coal or fuel oil, and gives an account of the methods used by UNIPEDE member countries in the campaign against atmospheric pollution. Both solid and gaseous pollution is considered. A summary of the various countries' legislative provisions is included.

**502. The Smog-Burner—An Automobile Exhaust Gas Burner.** Chromalloy Corporation. (Engineering, London, 191, **27,** January, 1961, 175). This device, designed on a mechanical principle and involving the use of only one moving part, is made from heat-resistant alloy coated by a chromalloy process. The burning action is made by a sparking plug which ignites the hydrocarbon gases in a cone-shaped chamber: the sparking plug is attached to the car's ignition system. It is easily installed on new or old cars, would be effective for the entire life of the car, and would have no adverse effect on petrol consumption, engine performance or engine wear.

**503. Pollution of the Air of Streets by Vehicles Using Ethyl Gasoline.** Dubrovskaya, F. I. (In Russian). (Gigiena Sanit., **25,** (4), 1960, 15-18). The following concentrations of lead in $\gamma$/cu.m. are given for 1958 (town, maximum and average are given): Tula, 0·50, 0·24: Chelyabinsk (1957), 15·00, 3·86: Kuibyshev, 1·00, 0·68: Gorki, 0.08, 0.03. In Perm where ethyl gasoline is not used, no lead was detected.

**504. Bench-Scale Investigation on Removing Sulphur Dioxide from Flue Gases.** Bienstock, D. and Field, F. J. (J. Air Pollut. Control Assoc., **10,** April, 1960, 121-5). The use of various solids as absorbents, as adsorbents and oxidation-catalysts for $SO_2$ was studied in bench-scale tests. This technique was found to be technically feasible: further commercial and cost studies will be made to determine its commercial prospects.

**505. Experimental Research on the Link Between Atmospheric Pollution and Lung Cancer.** Shabad, L. M. (Int. J. Air Poll., **3,** (4), October, 1960, 221-230). In this paper the experimental study of the carcinogenic effect of air pollution and its role in the etiology of cancer of the lung is discussed with particular reference to work in the USSR. The carcinogenic hydrocarbon 3:4 benzpyrene has been shown to be present in the atmosphere and in the smoke from Russian cigarettes. Tarry products from air pollution have been tested by skin painting and subcutaneous experiments in mice and malignant tumours were obtained in about eight per cent. of cases. Adenomatous lung tumours were also produced in mice. Earlier experiments had also shown that painting the skins of mice with tar increased the number of lung adenomas. Further, when the progeny of these painted animals were themselves painted with tar, lung adenomas occurred twice as frequently as in the parents.

**506. Invisible Injury of Bush Beans by Atmospheric and Aqueous Fluorides.** Applegate, H. G. and Adams, D. F. (Int. J. Air Poll., **3,** (4), October, 1960, 231-248). Bush beans, *Phaseolus vulgaris var. humilis*, when subjected to either gaseous fluoride or solutions containing fluoride, have abnormal oxygen uptake when compared with similar plants not subjected to fluoride. Plants given gaseous fluoride for 24 hours prior to harvest consistently had greater oxygen uptake than their control counterparts. Plants given continuous fluoride from time of germination had, with the exception of a short period around the fifth day, greater oxygen uptake than their control plants. Between the fourth and sixth days continuously fumigated plants had a lower oxygen uptake than the unfumigated control plants. There appeared to be little difference in respiration. This physiological disturbance induced by fluoride which has been demonstrated is considered to be an example of " invisible injury," by classical definition.

**507. Evaporated Metal Films as Indicators of Atmospheric Pollution.** Lodge, J. P. and Havlik, B. R. (Int. J. Air Poll., **3,** (4), October, 1960, 249-252). A substitute is proposed for present techniques of measuring atmospheric corrosiveness, namely the use of evaporated metal films a few hundredths of a micron in thickness. Glass slides covered with films of aluminium, iron, lead, copper and silver, were prepared and exposed in the Cincinnati area. Corrosion products were identified by means of X-ray diffraction and microchemical methods. Corrosion results in an increase in light transmission by the film, which can be taken as a quantitative measure of corrosion. Preliminary results showed aluminium to be the most dependable indicator of general atmospheric corrosiveness, although silver appeared specifically sensitive to a small group of pollutants, such as halogens, ozone, and sulphur compounds. Lead corroded so rapidly as to be difficult to interpret while iron was shown to be responsive primarily to relative humidity. Fair correlations were obtained with independent measures of pollution level. Some exploratory work was done on the measurement of the electrical resistance of the films.

**508. The Reduction of Air Pollution During the Reversal of a Producer-gas-fired Regenerative Glass Tank Furnace.** Bulcraig, W. R. and Haigh, J. B. (J. Inst. of Fuel, **34,** (241), February, 1961, 73-78). This Paper analyses the causes of raw producer gas and dark smoke emission at reversal and describes the methods used to reduce or eliminate each individual type of pollution. It is shown that during furnace reversal smoke emission from the chimney can be eliminated by valve regulation, and gas emission can be reduced by temporarily sealing the centre port of the Forter valve. It is therefore possible to effect safe reversals which conform to the Clean Air Act. There is no change in the furnace temperature compared with that during a normal reversal and furnace operating conditions remain normal throughout the test. The cause of explosions in the flues is discussed. Automatic operation of the damper sealing the centre port of the Forter valve has been successfully used for six weeks on routine working of a furnace.

# THE REALITIES OF REALISM

We have earlier referred to the mysterious "Council for Realism in Smoke Control" that operates in the North-West, organising opposition against smoke control proposals. This body sent out forms to residents in the Wythenshawe area of Manchester, inviting signatures to an objection against a proposed smoke control area. Over 400 people signed, thus making it necessary to call a Public Inquiry presided over by an officer of the Ministry of Housing and Local Government. But at the inquiry no representative of the Council for Realism was present, and there was no other objector to respond to an invitation to speak—so that the inquiry was closed almost as soon as it had opened.

The Manchester *Evening Chronicle* (December 15th, 1960) reported an interview with the secretary of the council, Mr. A. Ford, of Netherton, Bootle. Asked why he did not attend the public inquiry, Mr. Ford replied: "I was not invited by the objectors. After the last paragraph is a dotted line which objectors must sign if they wish me or a representative to attend. No one signed. In any case I could not have attended. I was at work all day."

Mr. Ford said that Councillor H. Holden of Preston was their president and chairman, but would not give the names of other officers. He said that they had eight branches, with an average membership of seven, but would not say where they were as "we do not wish local councils to know our plans." Later he admitted there were branches at Irlam, Patricroft, Burnley and Wallasey. The money comes from donations but he could not say how much they received or spent.

Mr. Ford added that he expected the Council would be wound up at the next committee meeting. The President, Councillor Holden, also interviewed, expressed surprise at this: "I know nothing about the Council being wound up. I did not know there had been a public inquiry regarding Wythenshawe until I read about it in the newspapers."


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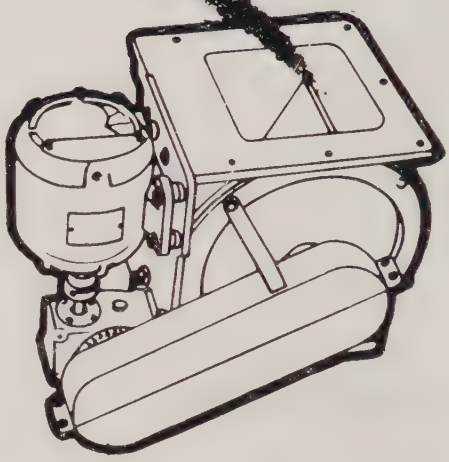
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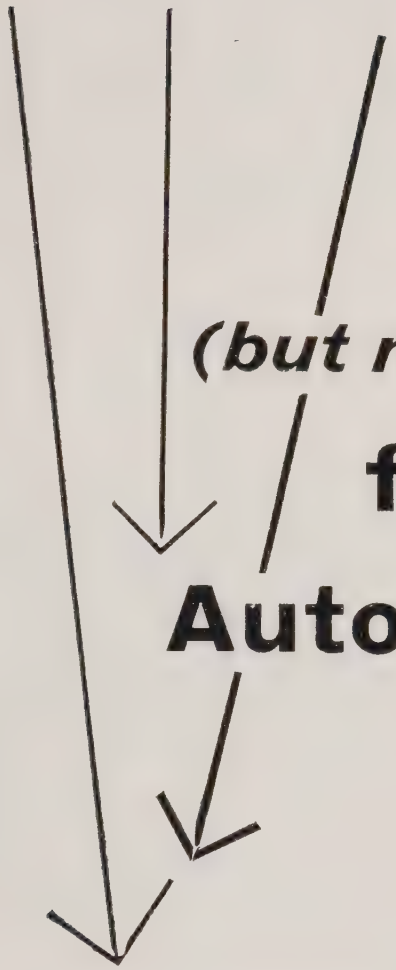
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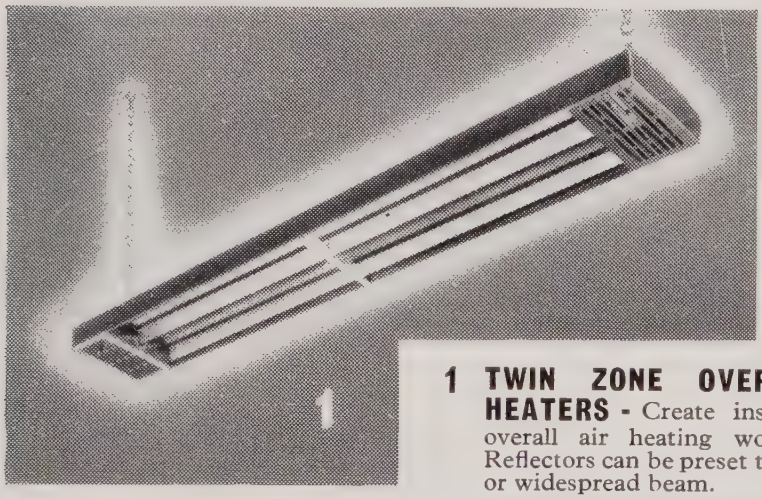
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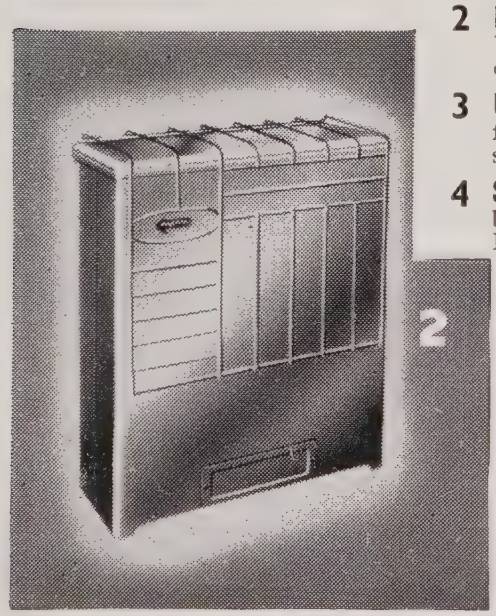


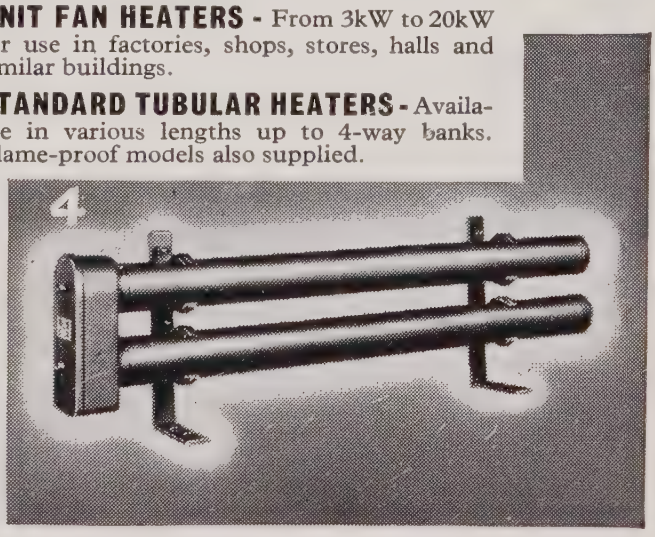
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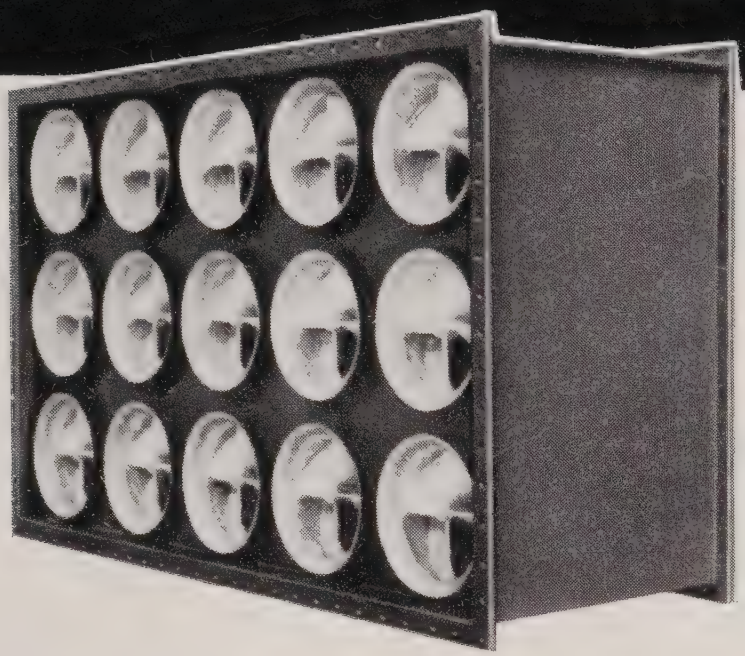
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## "R" Type
# DUST COLLECTORS



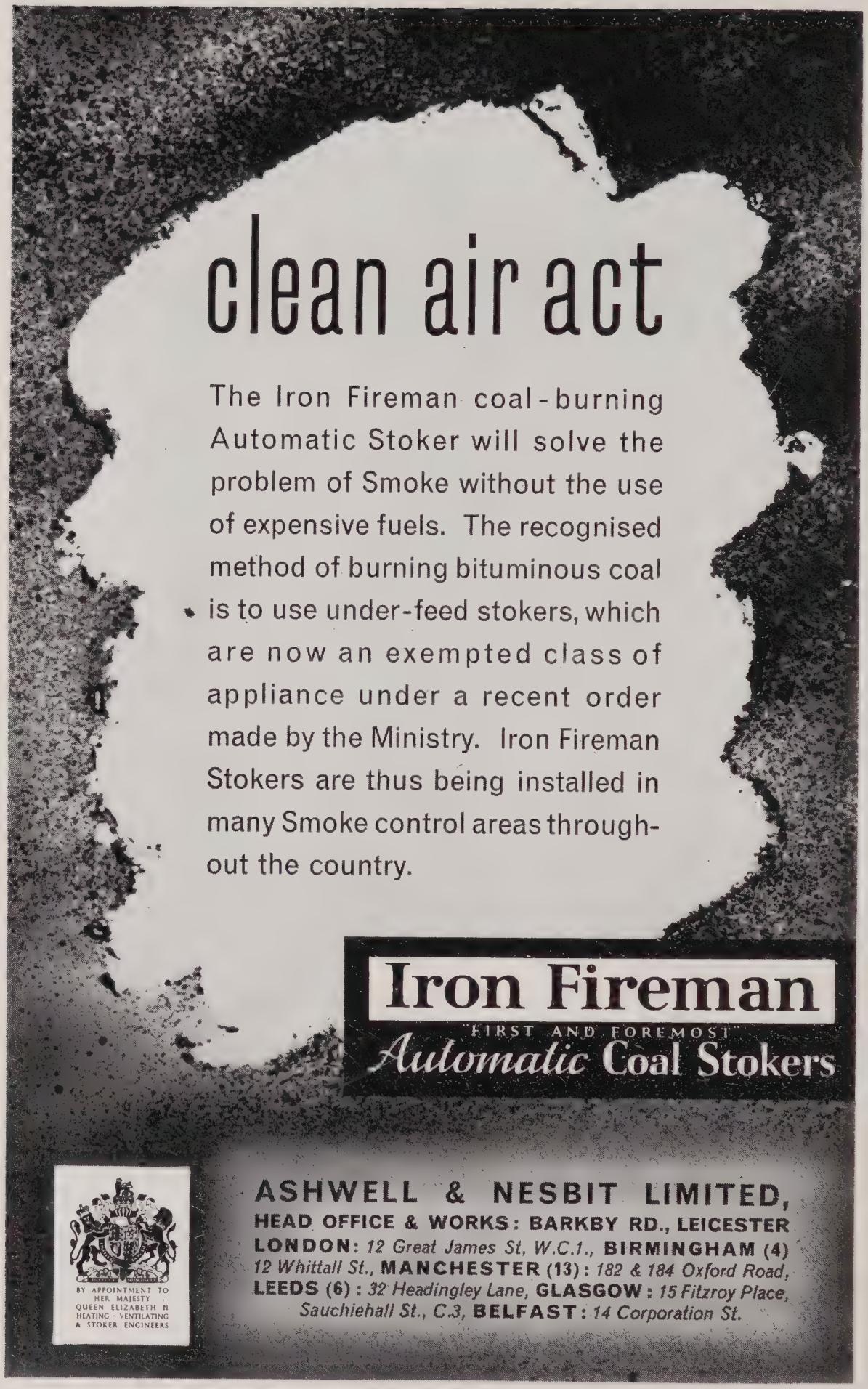
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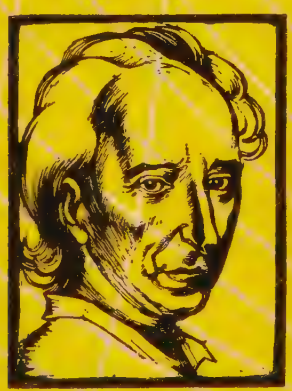
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JOURNAL OF THE
NATIONAL SOCIETY FOR CLEAN AIR



No. 118 ★ SUMMER 1961 ★ 2/-

*In this Issue*

The President ★ "Fumifugium" Tercentenary ★ Vertical Exhausts ★
Clean Air for New South Wales ★ Coal and the Clean Air Act ★
The Leamington Case

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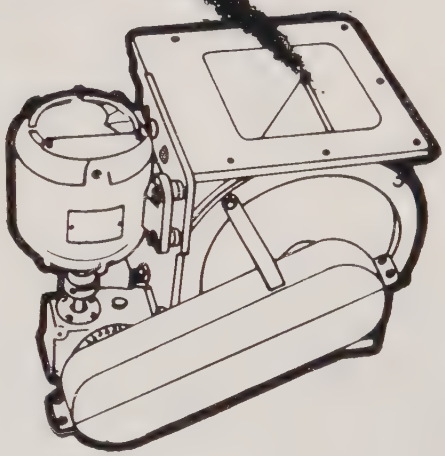
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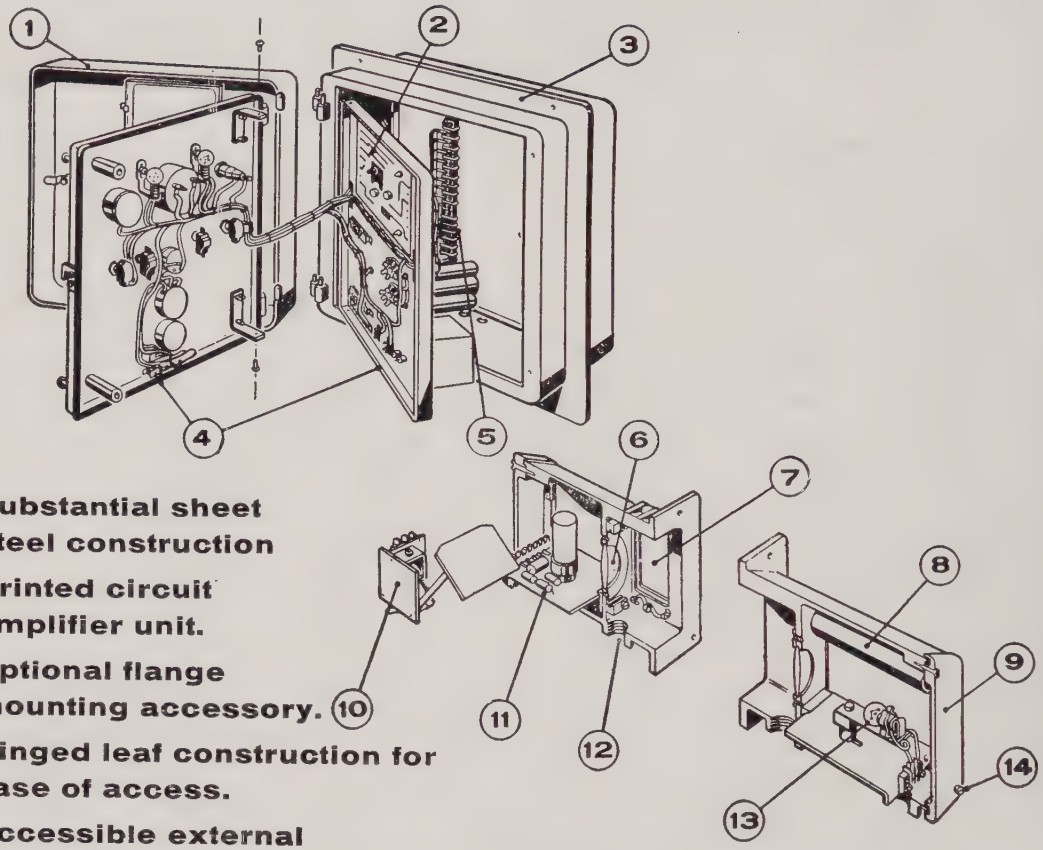
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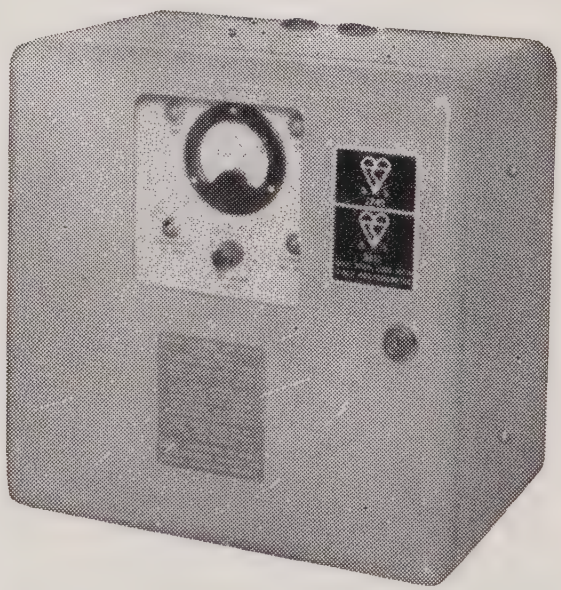
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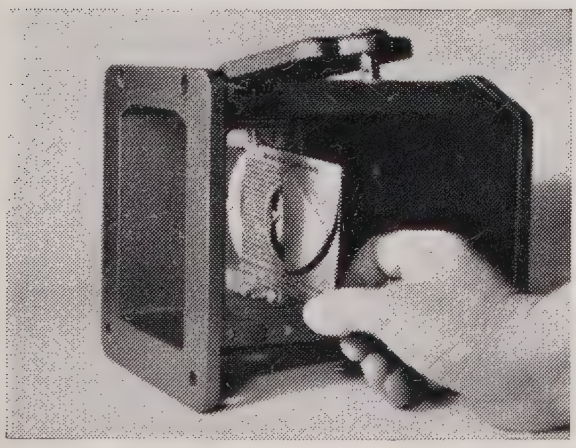
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*Calibration check by manual insertion of check slide.*

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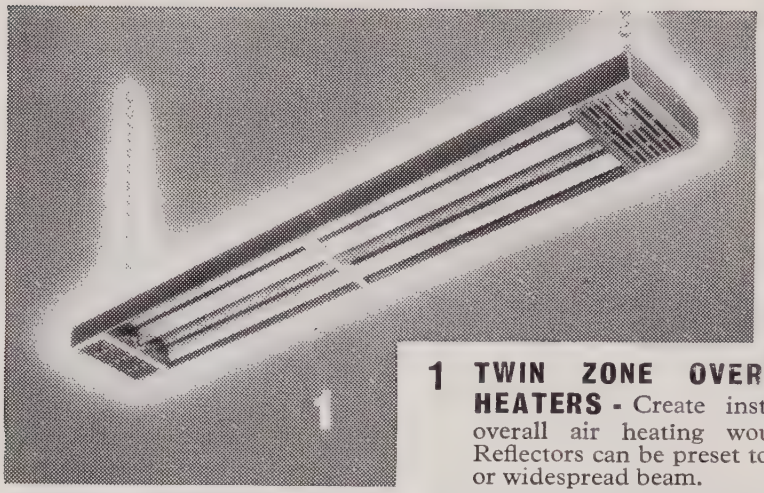
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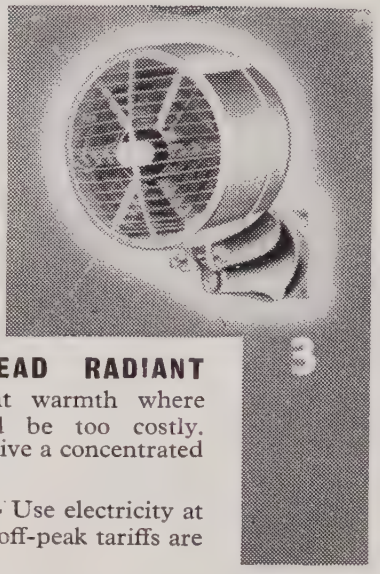
**of industrial electronic control equipment** SP.16c

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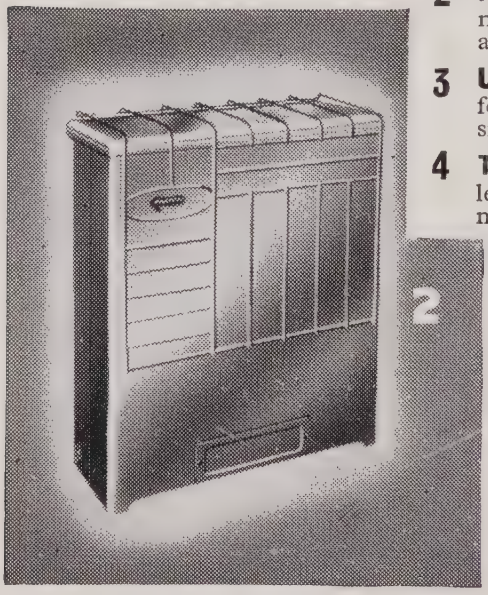



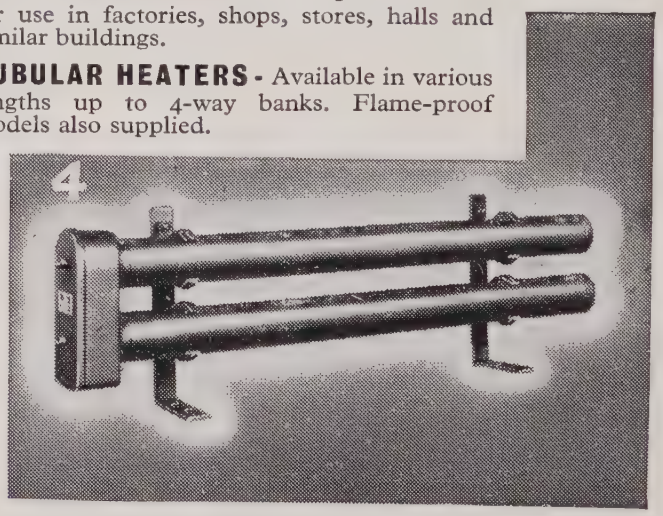

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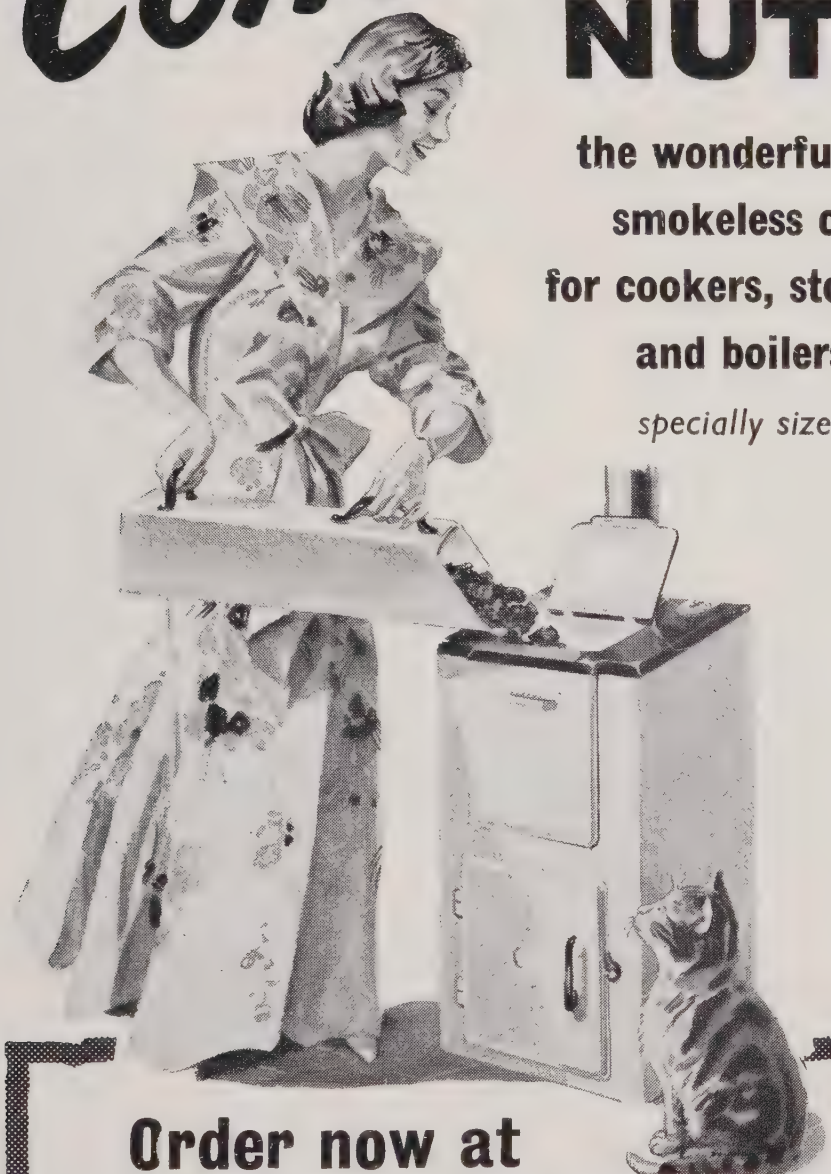
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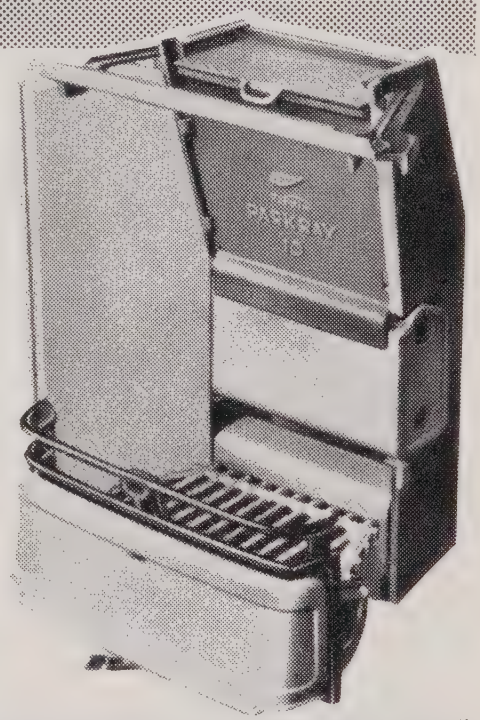
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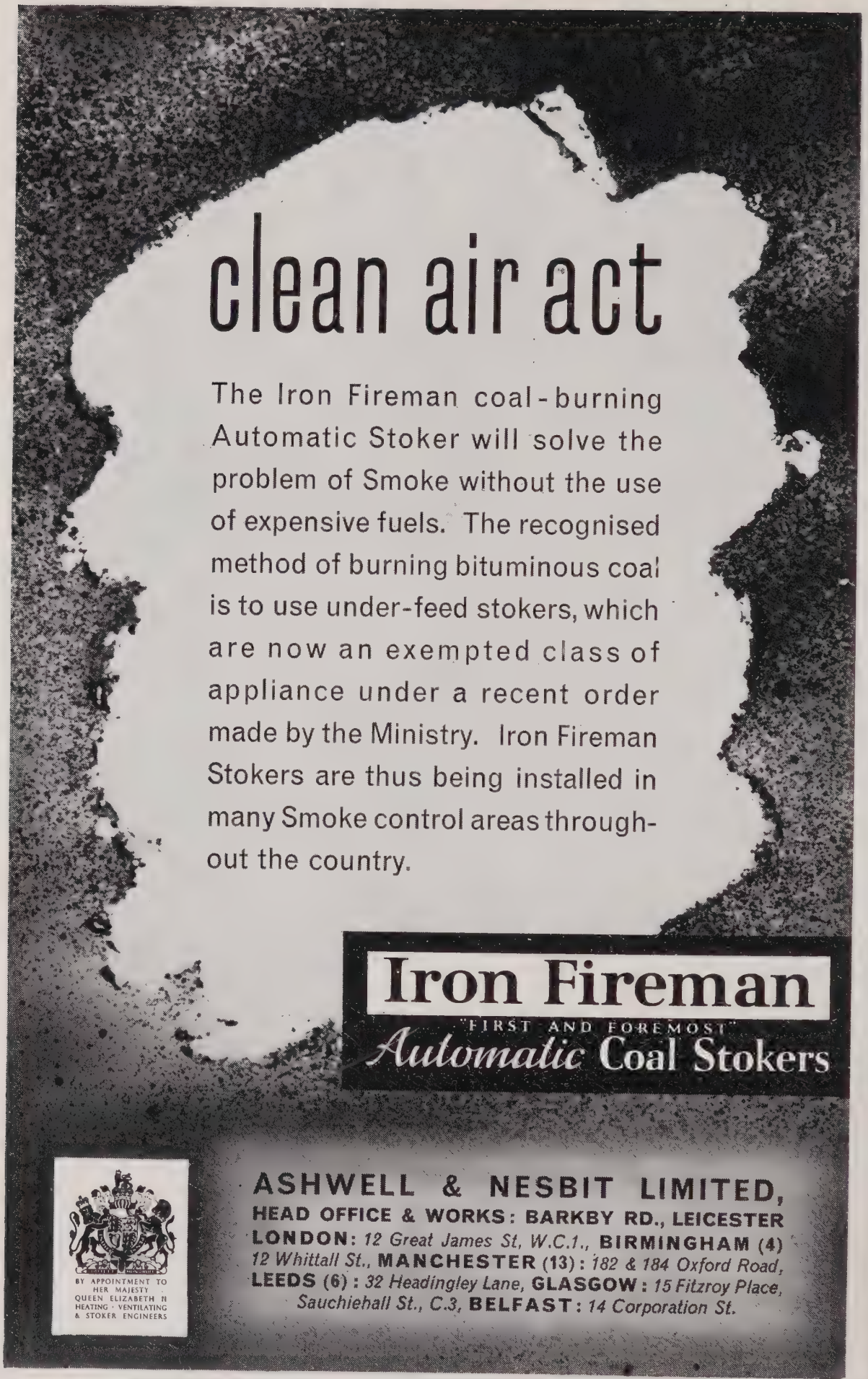
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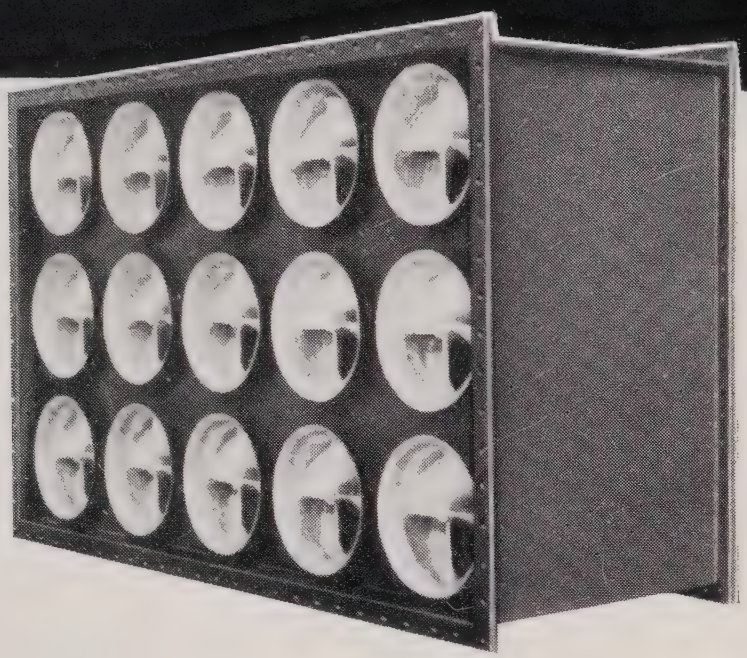
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- The resources of our Design, Experimental, and Testing Departments at Head Office, and the expert services of our various Branch Office Technical Staffs are available at all times to advise on the best and most economical approach to customers' individual requirements.

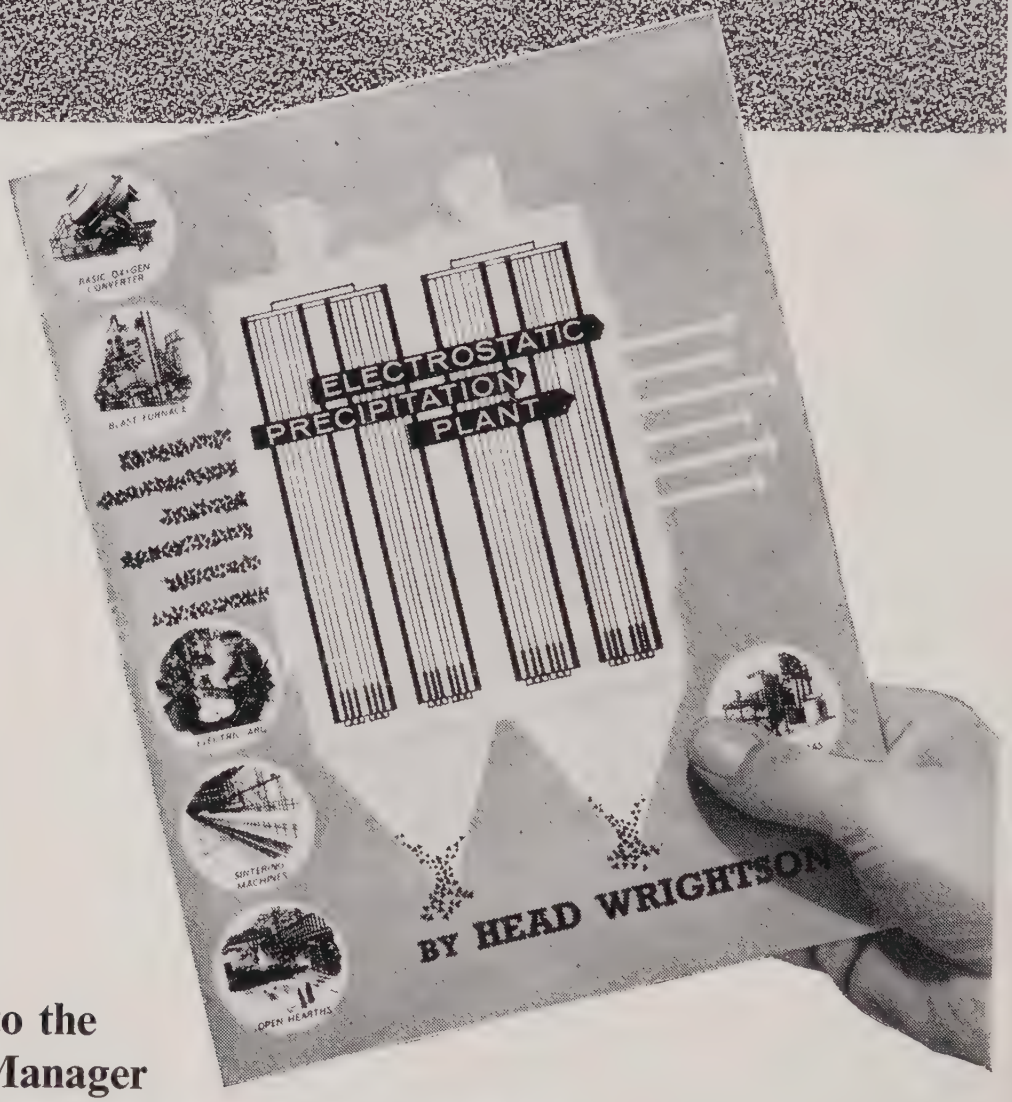
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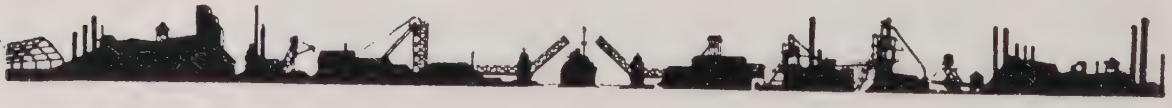
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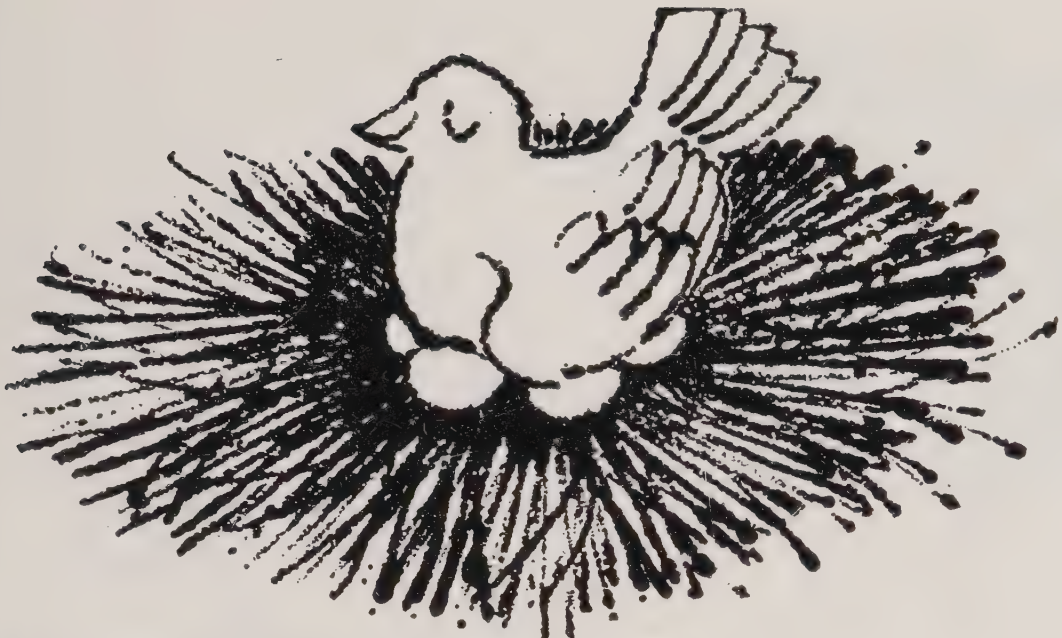

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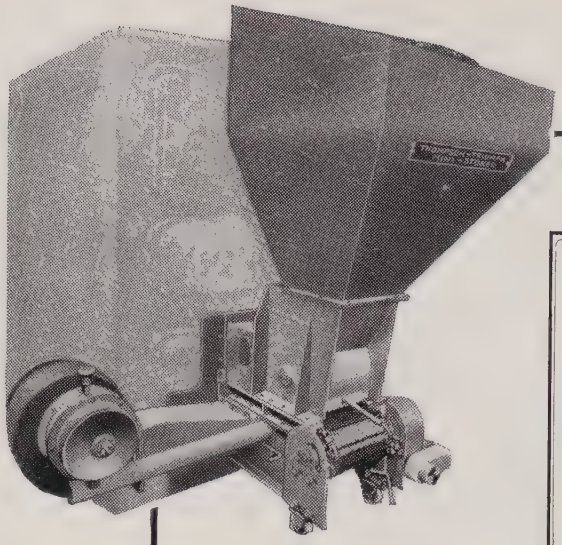
In fact, electricity cuts out sweeping, and any other kind of dirty work. Electric floor warming, for instance, can provide warmth and comfort in any new building—office, factory or home—for a very moderate running cost. Also, it is cheap to install; electric floor warming obviates the need for fuel stores, chimneys, and (alas for an old and time-honoured profession!) the need for chimney sweeps.

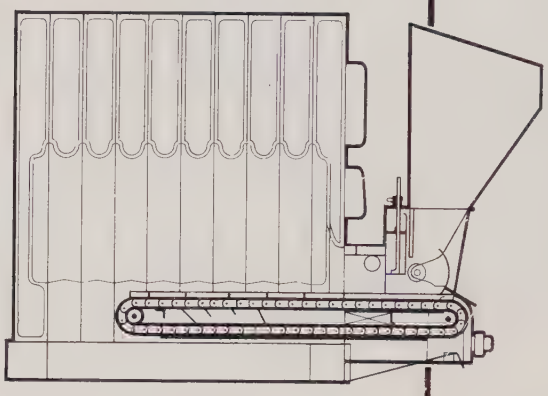
Electric cleanliness is becoming more and more desired and desirable; where new housing is concerned, people choose electric cooking, because it keeps the kitchen clean and new looking. All round—electricity is the modern way. You just plug in and enjoy electric living.

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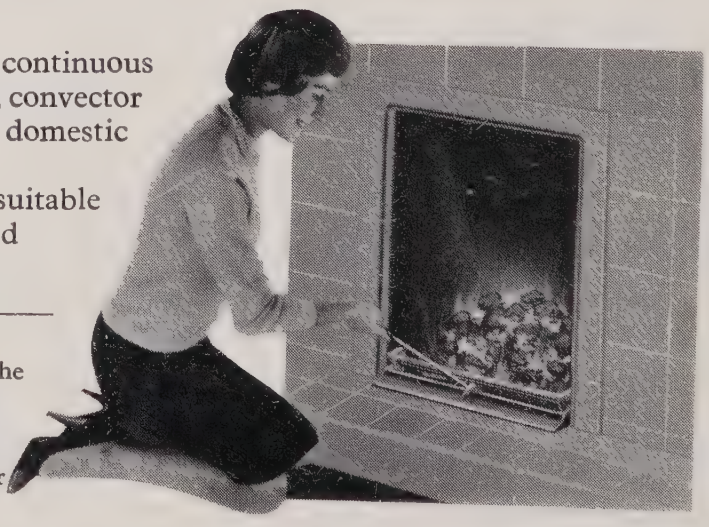
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## OVER 350,000 BAXI FIRES HAVE BEEN SOLD

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*Ships, towers, domes, theatres and temples lie*
*Open unto the fields, and to the sky;*
*All bright and glittering in the smokeless air.*

# SMOKELESS AIR

## *The President*

AT the Annual General Meeting of the Society in London on March 24th, 1961 it was announced that the only nomination received for the office of President was Lord Cohen of Birkenhead. He was therefore, amid applause, declared elected.

The Society is indeed privileged to have so distinguished and active a President. Born in 1900, Henry Cohen graduated at Liverpool in 1922, taking his M.D. in 1924, and becoming an F.R.C.P. in 1934. In that year he became Professor of Medicine in the University of Liverpool, and Senior Physician of the Royal Infirmary. He was knighted in 1949 and created First Baron Cohen of Birkenhead in 1956. For his services to medicine he has had honorary degrees conferred by the Universities of Ireland, Nottingham, Liverpool and Wales, and has been President of the British Medical Association. He is President of the Royal Society for Health.

In the field of public service Lord Cohen's positions have been many. He is Chairman of the Central Health Services Council of the Ministry of Health, and Chairman of the Ministry's Standing Medical Advisory Committee. He was Chairman of Ministry of Health Committee which reported on General Practice, Epilepsy, Welfare Foods, Prescribing, Poliomyelitis, Clinical Research in the National Health Service, etc. He was also Chairman of the British Medical Association committees which reported on the training of the doctor, and on general practice and the training of the general practitioner.



**The Rt. Hon. Lord Cohen of Birkenhead**

Lord Cohen has given many of the special commemorative lectures of the medical schools and colleges, and with respect to the written word he is Editor-in-Chief of the British Encyclopaedia of Medical Practice. Away from medicine and public health he is Chairman of the Board of Directors of the Liverpool Repertory Theatre Ltd. and Liverpool Playhouse Trust, and is Chairman of the Liverpool Council of Social Service.

Lord Cohen's Presidential Address to the Clean Air Conference at Brighton in October is an event to which all members of the Society will look forward with keen anticipation.

# *Smokeless Fuel Questions*

ON the solid smokeless fuels situation discussion and argument have no end. In this number it so happens that we publish reports of several meetings on the subject, while the whole question of smoke control area progress, at its present stage, together with the solid fuel problems associated with it are to be reviewed at the Society's conference at Brighton in October.

Much concern is expressed about the difficulties that may emerge as the smoke control programme develops, and there is anxiety about the trend of public likes and dislikes as between one fuel and another. The points raised are that the overall supply of smokeless fuel is going to be inadequate; that the supply of the more reactive (or " premium ") fuels is already inadequate; that gas coke is not popular; that the fuel-conserving closable (or openable) stove is not popular; and that although the much-heralded N.C.B. reactive fuel—the " Bronowski briquette "—might make a great difference we have waited so long for this that we cannot count on it until we see it.

These are all important matters, and if all are accepted the outlook for clean air becomes decidedly depressing. We believe, however, that they are either exaggerated or, where they do exist, can be overcome. The papers we report shed some light on them, and we may expect the Brighton discussions will clarify the situation even more encouragingly. But a brief look at some of the factors that call for examination may not be without value.

It is true that the more reactive fuels are becoming increasingly popular, despite their higher price, among widening sections of the public, and one of the difficulties is that this popularity extends outside the smoke control areas. Supplies are limited by the plant or even the coal available, and cannot be rapidly stepped up. Nor is it feasible to propose that their sales should be confined to existing or imminent smoke control areas. There is, of course, very much more coke available, including the B.S. quality " Gloco " for open fires. Now although many people do prefer the more freely-burning fuels, it is obvious that the present 300 smokeless zones and control areas—some of which have been going for years—would not be operating so smoothly and without fuss unless there was a big and accepted consumption of coke. It seems that in new smoke control areas there is more demand for the more reactive fuels because they are the nearest to the familiar coal fire, but before long there is a swing to coke. Coke may be less popular than it deserves to be, but it is certainly not generally unpopular, and we understand that in some areas, even outside smoke control, it enjoys—as Gloco—the biggest demand of all. What Gloco needs, we suggest, is a real national build-up, and it seems a pity that the name has not yet been adopted by all the Gas Boards, which means that it cannot yet be regarded and publicized as a national fuel.

Whether in the future, as the smoke control programme continues, there will be an overall shortage of solid smokeless fuel depends not only on the quantity of fuel available, but on how it is used and at what rate the change-over from solid to other fuels continues. Whatever the situation may prove to be there is no doubt that the dangers of an overall shortage, and consequent slowing down of the programme, can be reduced or even entirely removed, if all the smokeless fuels that are and can be made available are used to the fullest advantage. This means using the types and grades of fuel that are not suitable for open fires, and using them in the most efficient appliances—that is in closable stoves. Fuels suitable for stoves are the smaller sizes of gas coke and Gloco, and of the more reactive open fire fuels; an abundance of hard coke (now being marketed as

" Sunbrite "); Phurnacite, anthracite, and Welsh steam coal.

It is said that the stove is not popular, and that in any case because of its price it does not rate for conversion grant in smoke control areas where an open fire will do. The part that the stove can play in the future of clean air progress is however of such vital importance that every effort should be made to overcome these two difficulties.

Admittedly, the stove has not attained the popularity it deserves, but surely here lies a challenge to the N.C.B. and the other solid fuel interests. We understand that new designs are to be marketed, with a glass front instead of the dingy mica, and if these are reasonable in price the way is surely open for a full-scale publicity campaign for the closable stove. If the industries concerned were to get together for an advertising and popularizing campaign comparable in scale with the recent central heating campaigns, the stove might well " catch on " to the benefit of everyone. There is nothing inherently improbable about this: thousands are already in use in this country, and on the continent there are millions.

## *Grants for Stoves*

Such a campaign would be of value in itself, but its value would be immensely greater if stoves were to rank for grant and if their installation was positively encouraged in smoke control areas by the local authorities with the backing of the Ministry. That they should rank for grant has been suggested for the north-east,* where smoke control could at once be accelerated if, by the installation of stoves, large supplies of hard coke could be utilized. But there is a strong case for the grant being made available generally. It has been intimated that this is not possible because the grants are made under the authority of the Clean Air Act, which is concerned only with smoke prevention. This can be achieved by the use of the cheaper open fire, and although the stove is more efficient the Act is not concerned with fuel efficiency. True; but the situation now is that the greater use of the stove is essential if the Act is to be implemented, if at all, in the period intended by Parliament. Moreover, although the Act may not be specifically concerned with the abatement of sulphur dioxide, the reduction of this pollutant is a part of clean air policy, and very substantial reductions from domestic solid fuel usage can be achieved by the use of closable stoves. Their claim for grant can be based on clean air needs only, with efficiency forgotten—although for popularizing them the reverse may well be true.

It will be said that because stoves cost more many local authorities will be even more timorous than they are at present about embarking on smoke control in a vigorous way. This is unfortunately true, but again it is another challenge—something that can be overcome by putting the case for clean air more cogently to the authorities themselves. A minimum quality conversion may cost £5; installing a stove may cost £20 or more. Apart from the savings in fuel costs that will accrue to the householder the difference is less than the smoke pollution costs that are paid out by the average black area household every six months.

## *1984*

Lord Hailsham, Minister of Science, in a recent speech prophesied that by 1984 " the air, even in industrial areas, will be clear of smoke and dirt. Coal and oil will be increasingly raw materials for industrial products, and

* Since this was written it has been stated in the House of Commons (May 18th) that the Minister of Housing and Local Government has decided that in smoke control areas in those parts of the Northern Region where smokeless open fire fuels are scarce, grants may be paid on closed stoves which will burn hard coke.

will have begun to show signs of yielding before other sources of power of which nuclear energy will be only one." We are not sure whether this may be taken as a statement of Government policy and intention, or is the Minister's personal hope. We trust that he is right, but would ask him to look at the final target dates for clean air of some of the local authorities, as submitted to the Ministry of Housing and Local Government. He will observe that (unless someone demands a re-appraisal) that Warrington and Newcastle-under-Lyme do not expect to be smoke free until 1985, while Solihull, Blackburn and Sunderland reckon on 1989, and the County Borough of Derby is going all out for between 1990 and 2000. And then, of course, there are quite a number of other authorities (especially in South Wales) which have not got as far as a programme, and may not even produce one until 1984.

### *Smoke Control Progress*

The information published in each issue of this journal on smoke control area progress gives the latest returns, but not of course the overall position in detail. The Society's *Clean Air Year Book* for 1961, which will have been received by many readers, contains an important new feature—a complete list of the "black area" authorities, their final target dates, the final acreage, and the acreage actually operating at the end of 1960. We do not think that the information thus tabulated is available elsewhere and believe that the list will be both illuminating and of direct assistance to many.

## The Leamington Case

Concern has been expressed in the West Midlands over the regrettable retreat from clean air on the part of the Leamington Borough Council. The town is technically outside the West Midlands "Black Area", so that the opponents of clean air have been able to claim that it is a "White Area"—another indication that the black area designation is unsatisfactory. The Council had made a vigorous start on smoke control, perhaps conscious of the fact that a town which regards itself as a spa and health resort has a special need for cleanliness, including that of the air.

Four smoke control areas had been established and others had been planned, the programme being to cover the whole town in ten years' time. Active opposition, fostered and led by the coal trade had grown, and it has been reported that in the existing control areas coal has been burned for some time quite widely and without any action being taken against what is a legal offence. A shop in one control area has been openly selling prepacked coal.

As a consequence of the agitation the Council decided to: (1) rescind a smoke control order made at the previous meeting, covering 120 acres adjoining an existing control area. (2) Postpone the operation of Orders 5, 6, 7 and 8 from November 1st, 1961 to November 1st, 1963. (3) Ask the Minister to defer indefinitely consideration of Orders 9, 10 and 11. (4) Rescind their agreed policy of future smoke control, which would have covered the whole town in ten years. (5) Give further consideration to the whole question of smoke control before any new Orders are introduced, "in view of the uncertainty of the supply of quality smokeless fuel."

We understand that although there has been some shortage of the more reactive fuels there has been none of good quality continuous vertical coke. Seventy-five per cent. of the residents were found to be using coke, either alone or mixed with a "premium" fuel, and that 80 per cent. of them expressed complete satisfaction.

The *Leamington Spa Courier*, commenting on the Council's *volte-face*

said: "There is little doubt that pressure of public opinion has played the biggest part in the victory of the 'keep-the-coal-fires-burning' brigade," while the *Leamington Morning News* said: "The Council's change of mind will go down in local government history as a classic example of a Council bowing to the force of public opinion."

If we reject the view that the people of Leamington are abnormally backward it would seem that an insidious infection of public opinion, carefully fostered, took hold in Leamington and spread into the Council Chamber itself. It is hoped that other Authorities will benefit from their reflections on this case—they are not after all without experience in the control of infection.

The sorry part of it all is that Leamington calls itself a Spa, but is unable to seek one of the amenities that make a Spa a popular resort. Through its earlier enthusiasm it could have become Britain's first smokefree health resort, and "sold" its clean air as once it sold its waters. Clean air could have paid Leamington more handsome dividends than most places can expect—but as it is, the citizens of the town are to continue paying out the £400,000 a year that, on the Beaver estimate, is their share of the national cost of air pollution.

## WARWICKSHIRE CLEAN AIR COUNCIL

### *Leamington Criticized*

Allegations that a "put up job by certain elements of the fuel distribution trade" had led to Leamington Borough Council reversing its decision to implement a further two smokeless zones in the town were made on April 20th by Councillor Robert Looseley, of Coventry, deputy chairman of Warwickshire Clean Air Council.

Speaking at the quarterly meeting of the Clean Air Council at Sutton Coldfield, he suggested that distributors would have to make two journeys with smokeless fuel for every one of the same weight of coal. "I can understand the economics of the situation, but this campaign against clean air should not be allowed to go unanswered," he added.

He asked the Council to rebuke the action of Councillor H. Gibbons-Ward, of Leamington, who, he claimed, started the campaign by writing to the local Press.

### Reported Shortage

The council recorded its "concern and disappointment" at Leamington's decision to postpone the establishment of smoke control areas.

The Leamington Town Clerk, Mr. J. E. Stothert, told the council that the decision followed a reported shortage of smokeless fuels. He said he had thoroughly explored this matter and had found that such shortage was confined to premier grade fuels and that there were ample supplies of coke.

Mr. R. Haines, chairman of the technical advisory committee, told the council: "It seems to us that the opponents of the clean air policy are seizing on these alleged shortages as a reason against implementing smoke control areas for their own good reasons."

He said that at a meeting of his committee, manufacturers and retailers of solid smokeless fuels, the manufacturers had been confident they were already producing enough fuel for the present smoke controlled areas and they could cope with demands in any other smokeless zone.

He confirmed that any shortage had been confined to only the premier grades. He added: "We have the impression that the distributors just did not want to co-operate with others."

"*Coventry Evening Telegraph*" *Report.*

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**Presentation**—At the annual meeting of the West Midlands Division, N.S.C.A. at Belper on April 20th an inscribed silver cigarette case was presented to the former Hon. Secretary, Mr. G. W. Farquharson.

# *Three Hundred Years Ago*

## New Edition of First Clean Air Pamphlet

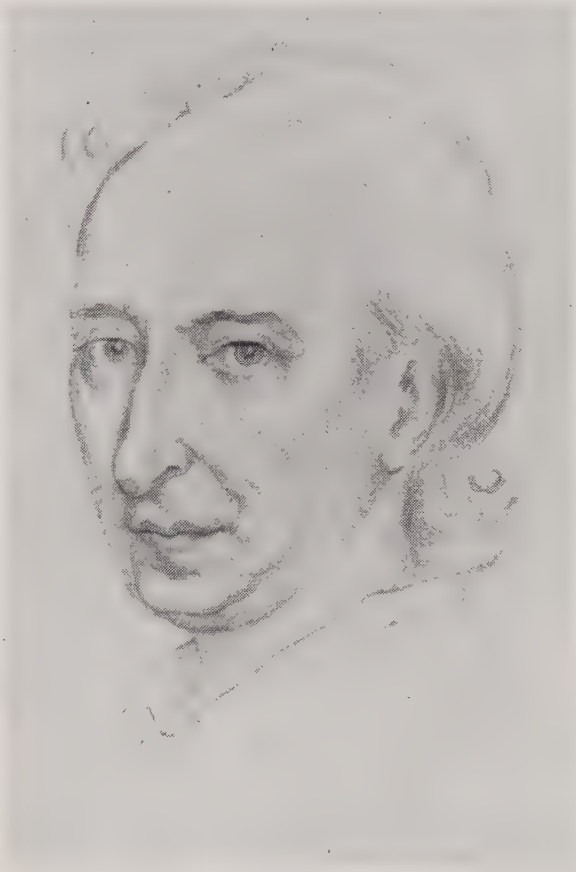
1661 may be said to be the beginning of the campaign for clean air. There had been much earlier efforts to have the use of coal prohibited in London, but it is exactly 300 years since the first considered examination and description of the city's smoke problem was written and published. John Evelyn, diarist, courtier, scholar, author, one of the founders of the Royal Society, expert on forestry, was appalled at the smoke and dirt that covered London and wrote his famous tract, or discourse, *Fumifugium, or the Smoake of London Dissipated*. The work is dated May, 1661, and it was in September that he presented it to Charles II.

King Charles, Evelyn records in his diary, "was pleas'd that I should publish it by his special commands, being much gratified with it." He also suggested that a Bill should be laid before Parliament—but this seems to have been the first and last interest of the King in clean air. Evelyn had penned a richly expressed, even passionate, indictment of London's atmosphere, together with imaginative proposals for its "melioration", but the effort failed, and to him the book also must have seemed a failure.

It is because of this, because of the opportunity of bringing some measure of posthumous recognition and success to the work, that there is an unusual pleasure in announcing the Society's tercentenary re-publication. If there was one publication we would enjoin all our readers to secure, to read and to relish, it is *Fumifugium*.

The Society published a reprint in 1933, and was gratified by the interest it aroused. But that is now out of print, and there seems no better time than the present year for a new edition.

It is available either as a paper-back at 2s. 6d., or cloth-bound at 5s.



**John Evelyn**

(Postage 3d. or 6d. extra.) Since it is a book to keep (or to give) we recommend buying the cloth-bound edition.

*Fumifugium* is well worth having, and for more reasons than one. It can be placed among the rarer classics and may be read for its literary qualities alone: its style, quotations and allusions, as well as the argument, are delightful. Then it gives us a unique picture of London of the time, as seen by an unusually perceptive observer. And finally those of our readers who either speak or write on clean air, will find in it many fascinating and eloquent passages from which to quote.

Thus, in the Epistle Dedicatory to "The King's Most Sacred Majesty", Evelyn explains how the book was conceived:

It was one day, as I was Walking in Your MAJESTIES Palace at White-Hall, (where I have sometimes the honour to refresh myself with the Sight of Your Illustrious Presence, which is the Joy of Your Peoples Hearts) that a presumptuous Smoake issuing from one or two Tunnels neer Northumberland-house, and not far from Scotland-yard, did so invade the Court; that all the Rooms, Galleries, and Places about it were filled and infested with it; and that to such a degree, as Men could hardly discern one another for the Clowd, and none could support, without manifest Inconveniency.

And then, in his preface to the Reader, the author waxes really eloquent:

That this Glorious and Antient City, which from Wood might be rendred Brick (like another *Rome*) from Brick made Stone and Marble; which commands the Proud Ocean to the *Indies*, and reaches the farthest Antipodes, should wrap her stately head in Clowds of Smoake and Sulphur, so full of Stink and Darknesse, I deplore with just Indignation.

The first part of the Discourse, as he calls it, is an examination of the nuisance, of the importance of pure, clean air, and on the harmful effects of living in (or even visiting) London. The observations on the effects of the smoke, the sulphur, and the suspected arsenical vapours, are acute and contain much truth, and now and then something unexpected. Thus:

For is there under Heaven such *Coughing* and *Snuffing* to be heard, as in *London* Churches and Assemblies of People, where the Barking and the Spitting is uncessant and most importunate. What shall I say?

*Hinc hominum pecudumque Lues*

And what may be the cause of these troublesome effect, but the inspiration of this infernal vapour, accompanying the *Aer*, which first heats and sollicits the *Aspera Arteria*, through one of whose Conduits, partly *Cartilaginous*, and partly *Membranous*, it enters by several branches into the very Parenchyma, and substance of the *Lungs*, violating, in this passage, the *Larynx* and *Epiglottis*, together with those multiform and curious Muscles, the immediate and proper Instruments of the *Voyce*, which becoming rough and drye, can neither be contracted, or dilated for the due modulation of the Voyce; so as by some of my friends (studious in *Musick*, and whereof one is a Doctor of Physick) it has constantly been observ'd, that coming out of the *Country* into London, they lost *Three whole Notes* in the compass of their Voice, which they never recover'd again till their retreat.

**The Origin of Premium Fuels?**

"A method of charring sea-coal, so as to divert it of its smoke, and yet leave it serviceable for many purposes, should be made the object of a very strict inquiry; and premiums should be given to those that were successful in it."

*—From the Preface to the 1772 edition of "Fumifugium", which is included in the Society's new edition.*

The material waste and destruction caused by the smoke is not overlooked:

. . . The weary *Traveller*, at many Miles distance, sooner smells, than sees the City to which he repairs. This is that pernicious Smoake which sullyes all her Glory, superinducing a sooty Crust or Fur upon all that it lights, spoyling the moveables, tarnishing the Plate, Gildings and Furniture, and corroding the very Iron-bars and hardest Stones with these piercing and acrimonious Spirits which accompany its Sulphure; and executing more in one year, than exposed to the pure *Aer* of the Country it

could effect in some hundreds.

The trouble caused to the ladies is not overlooked:

> How it sticks on the Hands, Faces and Linnen of our fair *Ladies*, and nicer Dames, who reside constantly in *London* especially during Winter) the prodigious wast of *Almond-* Water for the *One*, *Soap* and wearing out of the *Other*, do sufficiently manifest.



*Charles II, who failed to act on Evelyn's plea, suffers the indignity of a smoke blackened face on his statue in Soho Square*

Part II deals with the remedies, and here the author has proposals that link smoke abatement with town planning and the general improvement of the metropolis. His remedy for the smoke was simple: all the industries, breweries, soap and salt boilers, lime-burners, and the like should be banished from London—to the other side of Greenwich! The " culinary smoke " he considered to be of little account and that could be improved by *charking*, *i.e.*, carbonizing the coal.

A smoke abatement Act would not be without precedent, and Evelyn cites and quotes an Act of James I which prohibited the burning of ling and heath on moors in various northern and midland counties at unseasonable times of the year, for reasons that included the " grosse vapours and clouds " they caused.

Part III of the Invective (one of the author's own terms) is brief but idyllic in its conception. It is " an offer at the Improvement and Melioration of the Aer of London, by Way of Plantations, etc." Trees, shrubs and flowers (lovingly enumerated) would be so placed in and around London, in planned open spaces, so that " even the whole City would be sensible of the sweet and ravishing varieties of the perfumes, as well as of the most delightful and pleasant object, and places of Recreation for the Inhabitants ".

To us, knowing what in fact has happened to London, and what it now is, this may seem the naïve dream of a visionary. But one is not so sure that, if only there had been a few more Evelyns, in his own and succeeding generations, it could not have been accomplished.

Nearly thirty years ago the Society adopted Evelyn's portrait as its emblem. Re-reading *Fumifugium* again, and writing these notes upon it, makes one glad that this was done. He was not only the pioneer of clean air, but remains a lasting source of inspiration to us, his heirs and successors.

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**Darlington Prefers Smoke**

A deputation from Darlington Corporation has been to the Ministry to repudiate classification of the town as a " black area."

Councillor the Rev. M. A. Beaton, Chairman of the Health Committee, told the Council on April 6th that the deputation's visit had been successful and that action in urging the Council to undertake a large-scale smoke control scheme had been postponed.

It had been estimated that such a programme would involve a sum of about £500,000 in converting fires and fireplaces, etc. Councillor Beaton, who led the deputation of three, said " We have quietened the Ministry, we hope, for quite a time." (*Northern Dispatch*, *April 7th*, 1961).

# AIR POLLUTION–MEASUREMENT AND RESEARCH

## *Minister's New Circular*

The Minister of Housing and Local Government has issued, on April 10th, a new circular (No. 12/61), to Local Authorities on the above subject. After referring to section 25 of the Clean Air Act, under which Local Authorities may undertake, or contribute towards the cost of, investigations and research into problems, and drawing attention to the co-operative scheme for the measurement of air pollution, the circular continues:

" The essence of the scheme is the collation of measurements of air pollution of different kinds made by local authorities in various parts of the country, and the publication of results in a monthly bulletin, which is distributed to the participating bodies. The work of collation and publication is undertaken by the Department of Scientific and Industrial Research. The Department also send to co-operating bodies an annual report on the investigation of atmospheric pollution, in which general conclusions are drawn from the local measurements.

" Local authorities taking measurements under the scheme are able to assess the degree of different types of pollution in their area, or in different parts of their area, and to compare the position in their own area with that in similar areas in other parts of the country. The information thus obtained may help them to decide what remedial measures are necessary and their order of priority. Air pollution measurements also provide a means of judging the success of any remedial measures applied, and may provide a useful basis for publicity in connection with local authorities' smoke control programmes.

" Local authorities may participate in the scheme by taking and making available air pollution measurements or, whether or not they take measurements, by making a token contribution towards the cost of the services provided by the Department of Scientific and Industrial Research in connection with the scheme. Local authorities can obtain the advice of the Department of Scientific and Industrial Research on what type of instruments to purchase, how to operate them and interpret the results, and where to install them.

" Participating local authorities may send representatives to the standing conference of co-operating bodies, which meets twice yearly to discuss the running of the scheme and to consider papers on air pollution measurement or research. The conference elects its own chairman and a representative of the Department of Scientific and Industrial Research is the secretary. Bodies represented on the standing conference receive from the Department of Scientific and Industrial Research an annual report of conference proceedings.

" The monthly bulletin includes, as well as measurements, an annotated bibliography of published work on air pollution and air pollution research.

" Participation in the co-operative scheme thus provides a means of keeping in touch with the most recent scientific developments on means of abating air pollution, and of measuring it, and may suggest practical measures which local authorities can apply to their own problems.

" The central services provided by the Department of Scientific and Industrial Research in connection with the scheme (advice, secretarial work for the standing conference, the production of the various publications, and research work on problems of air pollution and its measurement) are largely financed from the Exchequer, but many authorities make a voluntary contribution towards these expenses. Local authorities buy their own

measuring instruments and provide the staff to operate them and to record the results.

" Local authorities whose areas are included, in whole or in part, in the Ministry's provisional list of black areas (these authorities are listed in the tables and footnotes in " Smoke Control (England and Wales) " (Cmd. 1113, H.M.S.O., price 3s.) and who do not at present take part in the co-operative scheme, are urged to do so, both in their own interests and in the interest of making the scheme as comprehensive and therefore as valuable as possible. Other local authorities will be very welcome to join the scheme if they care to do so. Applications to join should be made to The Director, Warren Spring Laboratory, Gunnels Wood Road, Stevenage, Hertfordshire.

" The present scheme of co-operative measurements is not sufficiently comprehensive to provide an accurate picture of the distribution of air pollution in different types of area throughout the country. A working party, which included representatives appointed by the standing conference of co-operating bodies, has drawn up a plan for the redistribution of some of the measuring instruments and for the siting of new instruments, in order both to remedy this defect and to provide a yardstick by which measurements can be compared with the average degrees of pollution by smoke and sulphur dioxide in various types of area throughout the country. The report recommending this modified scheme, which it is hoped will result in a national survey of air pollution by smoke and sulphur dioxide, has been accepted by the standing conference. Under this plan some authorities, including a few in relatively non-polluted areas, are being invited either to start taking measurements or to take measurements at new sites within their area. The Minister hopes that any local authorities approached by the Department of Scientific and Industrial Research on this matter will offer their full co-operation."

# *Vertical Exhausts*

The views expressed by Mr. T. H. Turner in the discussion on Mr. Harrop's paper (page 278) were elaborated in a letter to *The Engineer* (April 28th, 1961), which with the permission of the Editor we reproduce for the information (and perhaps comment?) of our readers:

## CLEAN AIR FOR CITY STREETS

Sir,—Whitehall is a good place to see the benefits that have already accrued from the Clean Air Act. Coal smoke has been eliminated from Government offices and the busy flow of shipping now passes up and down the Thames without visible smoke. Official measurements record a reduction in smoke and begin to show a decrease in sulphur dioxide. Old residents in Whitehall have noticed that nostrils, handkerchiefs and shirt cuffs are no longer blackened as rapidly as they were a decade ago. The propaganda of the National Society for Clean Air has thus borne welcome fruit.

But on the roads pollution seems to grow from ever more engine exhaust pipes. The unpleasant nuisance, and possible danger, of engine exhaust fumes in congested streets calls for a reappraisal of the location and direction of the pipes that emit these fumes. At the present time it is in the zone between knee and ankle that a man feels his trousers to be blasted by the exhaust from hard working engines, of buses and other vehicles that pass him as he stands on a city pavement. A mother of small children points out that that zone is exactly where the face of her child is when she seats it in a push chair. Male designers planned to emit the exhaust fumes at the rear on the offside, but with modern one way streets the offside is frequently the side nearest to the child on the pavement.

In one city in this country these horizontally emitted exhaust fumes were so regularly blasted right into the open doorway of a communal block of flats that popular protest caused a

bus stop to be moved. Why did they not ask for the direction of the exhaust to be moved? By what right do vehicle owners and drivers thus assault with offensive jets of hot and noisome exhaust gases, people standing or walking on the pavements that are expressly made for the use of people?

Many vehicles already exhaust their gases upwards; diesel railcars, military vehicles, ambulances, U.D.C. refuse collecting vehicles and most U.S.A. heavy road freight vehicles to mention a few of them. In the case that causes so much complaint of black smoke from badly maintained diesel engines, or misused engines, vertical emission of the exhaust at or above roof level of the vehicle would take the objectionable black smoke further from our noses and out of the line of sight of drivers of passing vehicles.

Should it be suggested that roof top level emission of vehicle exhaust gases may be a nuisance to people on the top deck of double decker buses, one is entitled to reply that the near ground level horizontal emission of engine fumes is a proved nuisance and a road danger. Cases of drivers being enfeebled or overcome by inhaling the carbon monoxide emitted by their own engine, or by other vehicles in city road jams, will be minimised if all vehicles be made to point their engine exhausts in the direction that the hot gases must eventually take in order to disperse from the streets—upwards.

May I therefore beg prospective purchasers of fleets of heavy vehicles to ask for a memorandum as to the feasibility of installing vertical exhausts before they place orders for new vehicles that may be run in city streets. If only a few big users of road vehicles would give such a lead others would follow because we need not remain slaves to this pollution of our streets.

Vertical exhaust pipes can be fitted in neatly, with front-engined vehicles at the side furthest from the driver, with rear-engined vehicles at the side furthest from the pavement, and with underfloor-engine designs the exhaust can rise vertically at either side. From an enclosed engine compartment the vertical exhaust could be made to suck the cooling air through the radiator and entrain for exhaustion all the unwanted engine blow-back fumes and hot oil smells, emitting them upwards above the nose level of passengers.

The relatively hot and narrow metal exhaust pipe could be surrounded by an artistically shaped larger and cooler tube made perhaps of fibre glass. The annular space so formed could serve to exhaust engine fumes and smells, just as big ship funnels have multiple passages and functions. Recalling the clever use of exhaust steam in the smoke-box of the classic Stephenson locomotive, to draw the air through the fire, one wonders whether I.C. engine exhaust can be used to regulate the suction of air through its radiator and to disperse fumes upwards. If road vehicle designers are now asked to try their hardest to arrange for the vertical emission of the engine exhaust they will find, we may hope, that it permits both freedom from engine noise and smells for their users, and courtesy to pedestrians.

Sooner or later the Ministry of Transport may be forced to require roof top vertical emission of engine exhaust gases for all heavy lorries, coaches, service vehicles, and for as many private cars as possible. Any case against vertical exhaust is so far not proved. A large scale experiment with hundreds of vehicles is urgently needed, and encouragement from the Ministry of Transport.

T. H. Turner

Derby,
March 27th, 1961.

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**The Benefits of Pure Air**

Dr. G. Nicholson, Medical Officer to Dulverton R.D.C., Somerset, told members of the Council on April 14th that he thought it could be attributed to the pure, smoke-free air in the Dulverton area that in the past eight years they had had only one death from lung cancer. He said that in the normal way they could have expected the total during the eight years' period to be between 16 and 18.

# THE BRIGHTON CONFERENCE

## A Full Programme

*Transatlantic Discussion Feature*



*The Royal Pavilion, Brighton*

THE Society's Annual Conference —the 28th of the series—and the Clean Air Exhibition—No. 4—will be held at Brighton on October 4th, 5th and 6th next. This is half a day longer than previously, for instead of finishing at mid-day on the Friday, there will be a session (and an important one) in the afternoon. Not as a consequence of this, but because of rising costs all round, the conference registration fee will be advanced by a half-guinea to 3½ guineas.

We are pleased to be able to announce that the Conference and Exhibition will be opened, on the morning of Wednesday, October 4th, by the Parliamentary Secretary, Ministry of Power, Mr. John George, M.P. For this opening session the chairman will be the Society's new President, Lord Cohen of Birkenhead, whose Presidential Address will be the other outstanding feature of the morning.

The programme, which has now been virtually completed, will be full and varied. A novel, and we believe a most valuable, new feature, will be a discussion on transatlantic (hi-fi) telephone between representatives of the Conference on the platform at Brighton and air pollution experts in the U.S.A., who will be speaking from New York. This event, which will be from 30 to 40 minutes, breaks entirely new ground for the Society's conferences, and will give substance to the efforts being

made on both sides of the Atlantic to achieve closer international co-operation in the field of clean air. The arrangements are being made possible by the interest and co-operation of the well-known pharmaceutical firm of Pfizers, Ltd.

The arrangements and details are at present being discussed with our opposite number in the States, the Air Pollution Control Association. On our side the Chairman will be our Past-President, Sir Hugh Beaver. The discussion will probably be at 4.30 p.m. on the Thursday, immediately after the ordinary afternoon session, which will be 11.00 a.m. New York time.

**The General Sessions**

The five sessions for papers and discussions will cover a broad field, mostly on subjects bearing on the Clean Air Act. On the Wednesday afternoon, however, there will be a report on the reception of the Society's proposals for a Bill for the Certification of Furnace Operators, and a report or review, by Dr. Craxford of Warren Spring, on the new National Survey on Air Pollution. Both reports are like to engender lively discussion.

Thursday will be devoted to industry. In the morning there will be a series of short papers on the industrial aspects of the Act—from the viewpoints of the Local Authorities (Mr. Batey, Sheffield), of fuel efficiency, (Mr. Opie of N.I.F.E.S.), of industry itself (Mr. Dickie of the F.B.I.) and of the manufacturers of plant and instruments by a nominee of the Combustion Engineering Association. In the afternoon questions on industrial problems are being invited and will be answered by a platform panel of experts. Although spontaneous questions from the floor will not be barred it will obviously be better if questions, and especially technical ones, are thought out and sent in beforehand. Questions in advance are, therefore invited, and may be sent in at any time beforehand to the Society's offices.

Friday will be a Domestic day. One paper only will be presented and discussed in the morning—on whole-house warming systems, including central heating and new methods. The author will be W. B. F. Shaw, of Warren Spring, who edited and wrote a number of the chapters of the admirable new book, *Domestic Heating*, recently reviewed in this journal.

On the Friday morning, the concluding session, the conference will turn, as no doubt every delegate will expect, to the progress being made and the problems arising in the establishment of smoke control areas. Two written papers will be presented: one by a local authority representative (Mr. Herrick of Fulham) and the other by a representative to be appointed by the S.S.F.F., to review the solid smokeless fuels situation. As the other smokeless fuels, gas, electricity and oil do not present the problems we find with the solid fuels papers are not being asked for on these, but the industries are being invited to be




*Conference delegates should not miss the fascinations of Brighton's famous old "Lanes"*

represented on the platform to deal with any questions that may concern them.

**The Social Side**

On the social side there will be the popular informal " get-together " on the Tuesday evening—at the Metropole Hotel (which incidentally will be the Headquarters hotel). The hospitality of the Mayor and Corporation of Brighton will be extended to delegates at Receptions to be held in the Royal Pavilion on the Wednesday and Thursday evenings.

There is nowhere a more delightful setting for such social occasions than the Royal Pavilion, but it is not large enough for the whole of our members and delegates, with their ladies. The receptions will be identical and each person will of course receive one invitation only. The allocation of tickets will be by chance, although it may be possible to try to ensure that friends who would like to be together receive tickets for the same evening.

This division of the Reception well illustrates the growth of the Conference since it last met in Brighton in 1946, when not only was the whole company entertained in the Pavilion together, but the conference itself was held in one of the rooms. This year the conference will be in the nearby Dome, with the Exhibition in the adjoining Corn Exchange and in a frame tent being specially erected in the grounds.

We are still receiving commendations for the quality, and consequent success, of last year's exhibition at Harrogate, and we think we can already safely say that Brighton, 1961, will be larger, more comprehensive, and more interesting. There is no doubt that the Clean Air Exhibition, started experimentally at Llandudno in 1959, has well and truly " caught on ". Exhibitors are finding that a modest *specialized* exhibition, catering for a specialized conference, can be more useful and less expensive to them than some of the bigger events. We do not know if exhibition values have ever been analysed, but we have a feeling that our Clean Air Exhibition is not far from the optimum in both size and returns to both exhibitors and (if there is such a word) exhibitees.

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**Fluorine Poisoning of Cattle in Bedfordshire**

According to a recent report in the *Daily Sketch* a large number of cattle on farms at Houghton Conquest, near Bedford, have died or had to be destroyed as the result of fluorine poisoning from brickworks.

It is alleged by one farmer, a Mrs. Samm, that she has lost £25,000 worth of stock, comprising 68 cows (including an entire Jersey herd), and 110 calves, as well as 500 chickens. Other farmers in the area also say that stock have been affected, and one said that she had given up keeping cattle.

It is said that Ministry of Agriculture scientific officers who have examined bone samples from affected animals have verified the presence of fluorine poisoning. The *Daily Sketch* photograph shows one of the affected cattle.



# INTERNATIONAL SECTION

*Australia*

## CLEAN AIR FOR NEW SOUTH WALES

*A Clean Air Act is being discussed by the Parliament of New South Wales, the background to which, its purposes and contents, can best be reported by quoting a paper by Mr. J. L. Sullivan, of the Division of Occupational Health, N.S.W. Department of Public Health. This was read to the Royal Australian Chemical Institute, and slightly abbreviated is abstracted, with acknowledgments from the* Proceedings *of the Institute, December, 1960.*

IN April this year, a Clean Air Bill was introduced into the New South Wales Parliament by the Minister for Health, the Rt. Hon. W. F. Sheahan, Q.C., M.L.A. Broadly, the Bill follows the recommendations of a special committee of industrial, university and government representatives appointed by State Cabinet in 1955. This committee was formed on a similar basis to the Committee on Air Pollution, appointed by the British Government some two years earlier, under the chairmanship of Sir Hugh Beaver. The British Committee was the direct result of the 1952 "Smog" disaster in London which undoubtedly also drew attention to the problem in many other parts of the world, including New South Wales.

The terms of reference of both committees were almost identical, namely "to examine the nature, causes and effects of air pollution and the efficacy of present preventive measures; to consider what further preventive measures are practicable; and to make recommendations". In Great Britain an immediate answer to the question concerning the nature of air pollution was available through the reports of many years of monitoring major contaminants but no similar records were available in Australia. Fortunately, however, a general survey of some constituents of the atmosphere had been commenced by the State Health Department in 1953 and these were presented in a report by the present author to an early meeting of the Committee.

The report concluded that there was ample evidence of an air pollution problem in the major cities of New South Wales. In terms of industrial pollution it was considered that the State's problem was comparable to that in most other developed countries although there were ameliorating factors such as the absence of appreciable domestic smoke and the existence of favourable meteorological conditions in the major cities. Because of the latter it was concluded that the possibility of large-scale acute health effects occurring could be virtually excluded.

On the basis of this report and other evidence presented, the Committee decided that more effective measures to control pollution from industrial sources and public utilities should be recommended. In this regard it was felt that the British Alkali Act, which the Beaver Committee had recommended be considerably extended, should serve as a model, as well as the Clean Air Act introduced in Great Britain in 1956. The final recommendations of the New South Wales Committee therefore largely represented a synthesis of the two British Acts. Briefly the main suggestions were:

1. That a new Act should be introduced to cover all forms and sources of pollution replacing all existing legislation on the subject.
2. That all industries and public utilities which presented special control difficulties should be scheduled as under the British

Alkali Act.

3. That a special control division should be established in the New South Wales Department of Public Health to administer control of the scheduled industries and to widen the scope of air pollution research generally.
4. That the scheduled industries should be subjected to the payment of a graduated scale of fees to partly offset the cost of establishment and operation of the specialized organisation, which would in turn be available to advise and assist on air pollution matters.
5. That the powers of local authorities to control the normal types of minor smoke problem be widened and be more clearly specified.

**Details of the Clean Air Bill**

Owing to the complexity of the problem of air pollution control and the wide public interest which has been expressed, the Clean Air Bill is to be left open for general comment for a period of some months. It is therefore not expected to pass through the final parliamentary stages until towards the end of the present year and in the meantime suggestions and comment have been invited from industries, organizations and members of the public generally. Copies of the actual Bill are available from the New South Wales Government Printer but some of the main provisions are described in the following sections.

**Scheduled Industries**

The Bill is divided into five Parts, and, as recommended by the Committee on Air Pollution, certain industries are scheduled. Control of these industries is dealt with in Part III of the Bill.

It is possible to vary the industries in the schedule from time to time according to circumstances but those set out in the Draft Bill are:

Any premises:

(*a*) being used for

brick, tile, pipe and pottery works,
cement works,
chemical manufacturing works of any kind including works in which plastics and insecticides are manufactured,
coal gas works,
metallurgical works reclaiming metal from scrap,
metallurgical works smelting or converting ores into metal of any kind,
oil refineries,

(*b*) or on which there are

coke ovens,
furnaces used for the melting of non-ferrous metals for casting purposes or furnaces and cupolas used for the melting of alloys of iron or steel,
boilers consuming more than one ton of solid fuel per hour.

Applications for licensing are to be made to the Under Secretary of the Health Department who may require the installation, alteration or repair of control equipment as a condition attached to the issue of the licence. In this category control equipment is defined to include air cleaning devices, as well as apparatus to secure more efficient operation of processes or to indicate the emission of air impurities. A licence cannot be refused to any industrial undertaking in existence at the time of proclamation.

Another major provision of Part III relates to future development of industries coming within the Schedule. From a time to be indicated it will be necessary for any person intending to commence operating a scheduled industry to first obtain approval concerning the proposed site, buildings and processes. This will also apply to major changes in existing scheduled industries.

**Prescribed Emission Limits**

In addition to control by the imposition of conditions on licences, the Bill also provides for the establishment of maximum emission standards as in the British Alkali Act. A differ-

ence in the New South Wales proposals is that provision is made for the limits to be prescribed by regulation rather than being included in the Act itself. This means that more time can be given to considering the proposed limits and there will be better opportunity for obtaining the views of industrial representatives and other interested parties. Moreover, greater flexibility will be possible enabling the special circumstances of any particular locality or set of conditions to be taken into consideration. Where limits of emission are not prescribed the Bill places responsibility on the occupiers of scheduled industries to use the best practicable means of controlling air pollution. This is a standard type of formula used in most present day air pollution acts. Exemptions from the prescribed standards can be given to industries in certain cases, such as experimental installations if warranted by special circumstances.

**Pollution from other Premises**

This forms Part IV of the Bill and refers to all types of premises other than those specifically scheduled. This Part of the Bill is mainly intended to apply to pollution from small boilers and similar minor problems where there are no special difficulties, and control is simply a question of direct supervision. There are no licensing provisions in this Part but the responsibility is placed on occupiers of premises to observe prescribed emission limits or to use all practicable means of preventing air pollution. Also provision is made enabling the Under Secretary of the Health Department or Local Authorities, to require the installation or repair, etc., of control equipment.

**Administration**

The major emphasis in the New South Wales Clean Air Bill has been placed on the scheduled industries which also include relevant public utilities. Experience has shown that the more important problems arise from these two groups. However, it was recognized by the Committee on Air Pollution that simple expedients such as the introduction of harsher penalties would be unlikely to succeed in controlling pollution and might very well prove harmful to the State's economy. Consequently, it was recommended that control of the scheduled industries should be entrusted to a central organization, composed of experienced technical personnel, located in the Department of Public Health. Such an organization might be expected to appreciate more readily the difficulties of certain industries and could work co-operatively rather than by legal pressure.

Though the present proposals of the Government envisage the full implementation of this recommendation, greater emphasis has been placed in the Bill on a part-time Air Pollution Advisory Committee. This is to consist of representatives of the government departments, universities, industrial and labour organizations with the Director-General of Health or his nominee as chairman. A chemical engineer and a fuel engineer, nominated by appropriate organizations, are also included. Briefly the Committee's function is to advise the Minister on matters concerning regulations and the administration of the Clean Air Act. The Committee may initiate the recommendations or alternatively matters may be referred to it by the Health Department.

There is no reference in the Bill to a full-time control organization but it is accepted that specialists will be required within the Health Department to work in association with the Air Pollution Advisory Committee. The major function of the central organization will be to undertake detailed supervision of the scheduled industries but it will also continue and expand the scientific research in which the Department has played a steadily increasing part in recent years. Staff attached to the administrative section of the organization will be basically derived from persons trained in chemical or fuel engineering. As already stated it

will be the function of both the Advisory Committee and the Control Organization to endeavour to assist and guide industry concerning pollution abatement measures rather than serving as purely inspectorial organizations. This will necessitate the recruitment to the full-time staff of persons not only with technical training, but also with considerable industrial experience.

Administration of control of pollution from sources other than the scheduled industries will be primarily the responsibility of City, Municipal or Shire Councils. Where necessary the central organization will assist by providing scientific advice and investigational facilities but otherwise is unlikely to play a direct part in control unless the circumstances are exceptional. The Local Authorities referred to will not be concerned with the scheduled industries.

**Effects on the Chemical Industry**

The chemical industry probably presents one of the most complex aspects of air pollution control. Many plants, by their nature, do not cause significant pollution but on the other hand some are responsible for the creation of difficult problems. Consequently, the industry as a whole has been included in the scheduled list, but it is envisaged that there will be many to which Part III of the Act will not be applicable and provision is being made for exemptions.

Generally, it can be anticipated that the majority of the heavy chemical plants will be licensed and where applicable will be required to observe emission limits. In most cases plant efficiency and the prevention of air pollution are common targets and hence no serious conflict of opinion is likely to occur between plant personnel and representatives of the control organization. Sometimes the standards of control to meet air pollution requirements may be higher than dictated by economy but conversely industries will not be subjected to some of the irrational demands which have occasionally occurred in the past.

The application of maximum emission limits is the method employed under the Alkali Act in Great Britain which was first passed in 1863 to control hydrochloric acid emission from the Leblanc process. Later, at various times, the Act has been widened and now covers most of the industrial sources of pollution in Great Britain. Legal limits apply to four processes, but in other cases works are required to use the " best practicable means " of controlling pollution for which certain " presumptive " limits are used to provide a reasonable guide. However since the inception of the Act almost a century ago, the guiding principle has been one of co-operation.

**Attitudes to Air Pollution Control**

An enlightened approach to the problem of air pollution control cannot be made in terms of hard and fast rules which subject industry to harassing restrictions. On the other hand, there are problems in existence and others will undoubtedly occur in the future unless effective measures are taken within a reasonable time.

The New South Wales Clean Air Bill is the result of approximately four years' discussions and research during which the views of representatives from many organizations, including industry, government and universities, have been considered. Yet it does not represent a fixed and inflexible piece of legislative machinery. When the Bill receives final assent, the rules and regulations to make it operative will be due for consideration. The initial framing of these will be the responsibility of the Advisory Committee but, through its power to create subcommittees, the views of interested parties should receive adequate opportunity for expression. This is an essential further step.

Then the responsibility for detailed administration will fall to the control organization of specialists acting in close liaison with the Advisory Committee. It should be possible for these

organizations to work in co-operation with industry which, as a general rule, is aware of the problem and is prepared to accept reasonable control. In New South Wales, the expressed views of a considerable number of industrial representatives has, so far, been unanimously favourable towards the proposals. Not infrequently, industry itself is the suffering party, when products are damaged or employees become disgruntled as the result of inadequately controlled atmospheric effluents from a neighbouring plant.

Consequently, implementation of a Clean Air Act could be regarded as a common aim of industry and the community alike working within a philosophy of co-operation. Air pollution abatement is not a subject for partisanship. The first essential requirement is objective scientific evaluation, and if a problem is apparent, common sense attitudes toward finding a solution must prevail. Only after all possibility of persuasion and co-operation has failed should a problem become a matter for litigation.

*Eire*

## FIRST REPORT ON A.P. MEASUREMENTS

Following is the substance of a first report from the Department of Local Government, Republic of Ireland, on the measurement of air pollution and the first year's observations. The tables of returns, analysed as in the British measurement reports, are not included.

The possibility of any notable air pollution in the Republic of Ireland has in the past been rather discounted owing to the limited amount of heavy industry and the predominant position of agriculture in the economy.

Changes and increases in the kind and amount of industry in recent years, together with the noticeable drift of population towards urban areas and the large increases in numbers of internal combustion engined vehicles, have given more point to the question of pollution levels. When to these considerations were added visual signs of the more obvious forms of air pollution, it appeared that some survey of the position was advisable if only on the basis that prevention is usually cheaper than cure. An assessment[1] of yearly pollution production from fuel consumption prepared for this Department and subsequently published, gave urgency to the introduction of some form of survey.

The Department took steps, therefore, early in 1957 to organize in co-operation with certain local authorities, a scheme for the measurement of pollution in the atmosphere. Initially a very limited programme covering the two largest centres of population and industry was envisaged with later extension to other areas. In arranging for this initial work and whilst consideration was being given to other aspects of the subject, the Irish cement industry offered their full co-operation in two areas outside the original basic programme. Consequently the first stations were set up in 1957/8 in Cork by the City Corporation and in Drogheda by the Cement Company in association with Louth County Council. These four stations each consisted of a deposit gauge and lead peroxide instrument. Results from these stations were available for 1958 but since the number was so small and re-siting of one station had been necessary during the period, it was not considered that any useful purpose would be served by publishing the results.

Later, Irish Cement Limited offered to erect an additional station in Drogheda and one in Dundalk, both in association with Louth County Council. Thus the present figures cover these six stations in Cork,

[1] Dawson, F. E. Air Pollution in Ireland, " Administration " Dublin. Vol. 6, No. 2. 1958.

**TABLE 1**

| Average deposited matter, grammes per sq. mile per month | |
|---|---|
| 1956 | 1959 |
| Bristol (4 stations) — 531 | Cork (3 stations) — 575 |
| Cleckheaton (2 stations) — 534 | Drogheda (2 stations) — 607 |

Drogheda and Dundalk.

Dublin Corporation have entered the scheme in 1960 with five deposit gauges and five lead peroxide instruments. Whilst the results from these observation stations will be useful, the area concerned is so large that at least a further five survey points would be required to give a reasonably comprehensive result for the whole city. This end has been achieved by the agreement of Messrs. Arthur Guiness Ltd., to set up an additional five deposit gauges and lead peroxide instruments in the Dublin City area.

In July, 1960, the Irish Cement Company consented to erect and service, in co-operation with Limerick Corporation, four deposit gauges in that city and these will be in operation in the final quarter of 1960.

Thus by the end of 1960 all the main areas which are considered likely to be foci of air pollution will be subject to some degree of measurement. The Department accordingly wishes to express to the local authorities concerned, their Chief Medical Officers and Health Inspectors, the Public Analysts, Messrs. Irish Cement, Messrs. Guiness Ltd. and their staffs, appreciation of the assistance given in the planning and execution of this scheme.

The figures for 1959 being for one year only and limited in numbers must be regarded with caution. Whilst not departing from this attitude, however, it is interesting to note the figures in Table 1. Results are given there for two areas in Britain for 1956 in contrast with two Irish areas for 1959. The comparisons admittedly are selective and are open to question. Nevertheless, Bristol though larger than Cork is similarly situated on a river with adjoining docks whilst Cleckheaton and Drogheda are both comparable in size and occupy steep river valleys.

It may, perhaps, be surprising to some that there should be such a degree of correlation between places in this country and industrial areas in the neighbouring island. It does emphasize also the necessity for the present programme and for even more detailed forms of investigation.

The Cork average *pH* values are all acidic, in the range 4·8—6·2; the lowest for any single station in any month was 4·2 and the highest 7·1. By contrast the Drogheda figures are in the range 6·7—7·9. No doubt the results of future years will enable more definite and reasoned comparisons to be made.

It may well be that other measurement, observation or abatement programmes for specialist purposes are under consideration by independent bodies in the country. The Department of Local Government, being responsible for the co-ordination of work in connection with air pollution in this country, would be glad to have details of any such schemes or research work and when possible to assist in their co-ordination with existing arrangements.

*Belgium*

## DIESEL SMOKE CONTROLS

The Belgian regulations governing diesel exhaust emissions state that " Motor vehicles should be regulated so as not to make smoke except in starting the engine " and some effort is being made to implement this

regulation. Testing of the larger vehicles for roadworthiness is compulsory, and the seven principal testing stations have been equipped with Hartridge-B.P. smokemeters so that a smoke test is also made. This testing for smoke is carried out on about half the vehicles to which the regulations apply, and is of an exploratory nature to gain experience of exhaust emissions and methods of measurement. Eventually it is hoped to be able to establish standards of emission which can be enforced.

At present, a simple test is carried out on the stationary vehicle; the accelerator is fully depressed and as the engine speed increases the maximum smoke registered on the meter is noted. If a meter reading of greater than 75 is obtained then the fault must be corrected with 15 days. Readings of between 45 and 75 show that smoke is emitted and this fact is drawn to the owner's attention. A reading of less than 45 indicates that the engine is satisfactory.

A reading of 75 on the Hartridge-B.P. Scale corresponds to a concentration of 0·56 g/cu. m. of smoke in the exhaust. Many of the lorries seen on hills in England emit smoke which has a concentration up to three times this value.

Although the Belgian approach to the problem of diesel smoke may not eliminate it completely from their roads it is clear that a similar approach in this country or even the " spot checking " of vehicles on the road, with consequent penalizing of offenders, could do a great deal to restore the diesel engine to its proper status.—*From L. E. Reed.*

*Belgium*

## ROAD VEHICLE POLLUTION

The Editor of *Technical Aspects of Road Safety*, the Bulletin of the International Centre of Information on Motor Vehicle Inspection Techniques, says (in the March issue) that of six subjects requested by readers in reply to a questionnaire, air pollution was most in demand.

The issue actually contains two articles on the subject. In the first of these the author, L. F. Ardoullie, continues his survey commenced in the previous issue. In this issue he deals with the subject of improvements to the methods of sampling and analysis, in order to study the composition of exhaust gases in all circumstances of road traffic. The different means to prevent exhaust gases from polluting the air are reviewed. In conclusion, he outlines a study programme for any action against air pollution by exhaust gases.

The second paper, on the detection of Diesel engine exhaust smoke, is by F. P. Malschaert, and is a sequel to the one by the same author in the September issue of the bulletin. It gives a brief account of the work done in the Laboratory for Automotive Engineering of the Ghent University between March and December, 1960.

There is first, a description of the equipment used for the simultaneous recording of engine speed and smoke density when the engine runs either in acceleration or deceleration, with full injection. The author then gives a possible correlation between the readings of Bosch and Hartridge meters, based on numerous tests made with precombustion chamber engines, and works out the formula of this probable correlation in a diagram with rectilinear coordinates. The article then mentions the modifications to the Hartridge meter in order to ease its " breathing ", to ensure the regularity of the readings and to allow its use in the case of small and slow engines. The tests are then described which led to the conclusion that the free acceleration method generally gives equivalent results to those obtained by the constant speed method.

Finally, statements made to the author by eminent German and British specialists tended to the view that atmospheric 3-4 benzpyrene is not a cause of lung cancer.

*Germany*

## INVESTIGATION OF ATMOSPHERIC POLLUTION IN THE CITY AREA OF ESSEN

The Technical Monitoring Association of Essen, during the period November, 1955 to February, 1957, carried out dust deposition measurements at 600 different locations in the city area of Essen, using dust adhesion foils, of the DIEM pattern. (Professor Dr. Max Diem, Karlsruhe).

The Association has published the results of the investigation by Karl Schwarz, Traugott Gilbert and Elisabeth Ratzki, all of Essen, in Bulletin No. 3, 1960. The following are some of the major points arising out of the investigation.

In the mid-year period the dust deposit in the southern district of Essen remains below 30 g/m² per 30 days, whereas in the northern areas the values increase to over 50 g/m² per 30 days. A decrease in the measured dust deposit is noticeable in localities where trees and shrubs abound. During the period of measurement the predominant wind direction was south to south-west. High initial concentrations carried by winds from the west over the northern area to the east, and attributed to dust sources outside the city area, were noted in the areas adjoining the northern boundary of the city. The distribution of dust deposition varied only little during the summer and winter months from the overall year distribution. No increase in dust deposit could be attributed to domestic sources during the winter. In the proximity of local emission sources considerable variations were experienced dependent however on wind direction and exposure time. Against this however, the dust deposit in the built-up areas of the city varied in small extent from the relative high average. Basically it can be observed that with an increase in the time of observation, average values of the dust deposition can be obtained which give a representative picture of local dust deposition; the average monthly values of dust deposition can fluctuate at a measuring point temporarily and in a limited measuring area also locally, dependent on the different meteorological influences and, at the same time, also on the conditions of source and diffusion of the deposited dust within considerable boundaries as shown by the monthly distributions. Such fluctuations do not occur in the average values over the year. The yearly deposit distribution does not indicate irregular variations of local dust deposition; it is balanced.

The results of the measurements have contributed to the clarification of the conception of " dust levels " in relation to an industrial area and have shown the direction in which establishment of permissible values for dust deposition could proceed. In the expected " Right Lines to Limit the Boundaries of Dust Deposition " of the V. D. I. (Association of German Industries) " Commission on Maintenance of Clean Air " a " dust level " could be fixed on a long term average, *i.e.* six months to one year; and in unfavourable conditions a permissible short-term value, say the monthly average, could be fixed as a short-term " dust level ".

The type and composition of emitted dust particles collected on foil were examined with the help of micro colour photographs. A comparison was made of photographs of foils which had been prepared artificially with special dust samples. In this way it was possible to establish qualitatively the identification of the composition and the source of the deposited dust in the city area of Essen.

It was found that the recognizable dust gathered by the DIEM adhesive foil method and magnified 28 times was composed of unconsumed coal dust, fly coke, fly ash, and slag particles and street dust (quartz etc.). To this could be added localized and distinguishable oxidized metal admixtures. Of interest were multi-coloured glass-like spherical bodies of 10 micron size, which point to sources of combustion processes involving high

temperatures as in smelting furnaces and others of a similar nature.

Micro colour photography gives in the first instance evidence of particle size, composition and type of the dust deposit, and gives a picture of factual distribution over a small surface (adhesive foil). In addition, it could be the quickest method in the identification of the composition of deposited dust. However, in order to establish an exact dust analysis, an additional chemical analysis of the dust deposit is necessary.

*Translated from the German by Charles W. Lamb.*

## THE MEASUREMENT OF DUST DEPOSITION

(*by* KARL SCHWARZ)

The first requirement arising from the " Clean Air Law " is the setting up of maximum permissible values for pollution of the air. A pre-requisite here is the availability of proved dust-measurement methods. In addition to the measurement of dust concentration in the air it is today usually simpler and more convenient to determine the dust deposition. The requirements which such a method for measurement of dust deposition must fulfil are indicated and methods which at present come into the question (the funnel method, adhesion foil method) are considered in more detail. Examples of dust deposition measurements illustrate the discussion.—*Abstracted from paper by Karl Schwarz, Technical Monitoring Assoc. of Essen. Bulletin No. 3, 1960.*

*U.S.A.*

## STATE LAWS

We have received from the U.S. Department of Health, Education, and Welfare, a copy of their useful publication " A Digest of State Air Pollution Laws ". This is a revised edition of a publication printed in 1959 and includes State laws enacted during the year 1960. Even where States have no specific air pollution legislation information is given about general nuisance provisions and control powers. The Digest does not include particulars of City ordinances.

## MAJOR RESEARCH PROJECT ON HEALTH EFFECTS OF AIR POLLUTION

A major research project is now underway which should add valuable information to what is known about the health effects of air pollution. The study is a joint project with the Los Angeles County Air Pollution Control District, and the University of Southern California to observe the effects on laboratory animals—mice, guinea pigs, and rabbits—of breathing the same air as that breathed by people in Los Angeles County.

The contaminants of primary interest are those specifically associated with automobile exhaust—hydrocarbons, oxidant, carbon monoxide, oxides of nitrogen, and certain particulates.

While the test animals breathe the air at special sites located at varying distances from the heavily travelled throughways, a control group of similar animals will be living in purified air from which contaminants have been removed. The study represents the largest research effort of its kind yet undertaken in the field of air pollution.

The National Advisory Committee on Air Pollution to the Surgeon General of the U.S. Public Health Service has been reorganized.

The membership has been increased from 12 to 15, with five members from industry, five from State and local governments, and five representing universities, professional associations, and the public. For the first time, a staggered tenure plan has been established so that five members will be replaced each year with new three-year appointees.

The committee was created in June, 1957, to advise the Surgeon General on the Public Health Service's policies, objectives, and accomplishments in the air pollution field.

## DEVELOPMENTS IN THE UNITED STATES

**(from Arthur C. Stern)**

### Technical Meetings

The American Industrial Hygiene Conference held at Detroit, Michigan from April 9th to 13th included a section on Air Pollution with Papers on such matters as practical sampling procedure and air pollution as determined by corrosion rates in test materials. A Stanford Research Institite International Symposium on chemical reactions in the lower and upper atmosphere, held in San Francisco from April 18th to 20th also contained a Session devoted to Papers on chemical reactions in contaminated atmospheres. The fifty-fourth Annual Meeting of the Air Pollution Control Association will be held from June 11th to 15th, 1961, at the Hotel Commodore, New York. Abstracts of the Papers given at the first two conferences are obtainable and they will also be obtainable for the Papers to be given at the APCA Meeting.

### State Air Pollution Legislation

The following States of the United States have within the last few months adopted new State wide air pollution legislation; Indiana, West Virginia, and Washington.

### Reports of Surveys on Air Pollution

During recent months reports of studies in Florida and Minnesota (see Abstract 533) were published.

### Publications

A number of new publications have been produced by the Division of air pollution of the Public Health Service and a list dated January 1st, 1961, is available.

### Activities in California

The Air Pollution Foundation has published its Final Report No. 33, Technical Progress Report. The Foundation is being liquidated during this quarter.

The State of California Motor Vehicle Pollution Control Board has been organized, with the Board consisting of 13 members, with Dr. John T. Middleton of the University of California at Riverside as Chairman. The Board has appointed Dr. Donald A. Jenson as its Executive Officer and Mr. Gerhardt A. Hass as its Chief Engineer. The Board has established offices at the State Building, 217 West 1st Street, Los Angeles 12, California, and has issued specifications for requirements and testing of crank case blow-by control devices. It has distributed specifications for acceptability and testing of exhaust control devices for commenting criticism prior to adoption. The Board is expected to have adopted its requirements for exhaust control devices by the time the Summer issue of *Smokeless Air* has gone to Press.

### Petroleum Fuels Ruling

A Hearing was held by the Los Angeles Board of Supervisors concerning the rule of the Board requiring that fuels burned in Los Angeles for certain months of the year have less than the specific sulphur content. Representatives of the Petroleum Industry requested the hearing in an effort to have this rule relaxed. However, as a result of representations of the Board of the Los Angeles County Air Pollution Control District Representatives the Board instead of relaxing the rule, made it more stringent by increasing the number of months during which it applied by one additional month.

*France*

## TECHNICAL ACTION COMMITTEE

As previously reported (Winter, 1960, p. 113) a Committee for Technical Action against Air Pollution has been set up in France. Nine working parties have now been instituted. These groups, to which a number of noted specialists in professions allied to the subject bring their

services, have undertaken an important working programme, as follows:

*Group I* (President, M. Bernard; Rapporteur, M. G. David) is to classify fuels with regard to pollution and to list their nature and quality according to the field in which they are utilized.

*Group II* (President, M. Vercouter; Rapporteurs, MM. Rabaux and Yribarren) is concerned with individual domestic appliances and equipment for central or collective heating, and the introduction of a system of methodical measurements to perfect existing knowledge on the composition of domestic pollution.

*Group III* (President, M. Guy, Vice-President Rapporteur, M. Vuillemin) is subdivided to undertake three specialized studies on problems pertaining to industrial boilers, metal-working furnaces and furnaces for non-metallic products.

*Group IV* (President, M. Jouano, Rapporteur, M. Lasserre) is concerned with the choice of apparatus for the removal of dust from fumes and gases.

These last two groups have first of all begun an extensive inquiry within the industries concerned to gather the maximum of results from actual working practice.

*Group V* is to formulate a constructive list of recommendations for the general information of domestic users, for the instruction of employees on the operation of heating equipment, and on the training of operators of important heating equipment.

*Groups VI* (President, M. Epron; Rapporteur, M. Profit), *VII* (President, M. Fabre; Rapporteur, M. Lecoeur) and *VIII* (President, M. Godard, Rapporteur, M. de la Hitte) are to undertake within the framework of their respective professions (iron and steel, cement and chemicals) a wide inquiry, co-ordinated with the other groups.

Common scientific problems emerge from this working programme, and *Group IX* (President, M. l'Ingénieur Général Avy; Rapporteur, M. Givaudon) will deal with these in order to make corresponding methodological studies.

As from this first quarter of 1961 syntheses of conclusions will be able to be drawn, and will be submitted to the public authorities.

**Smokeless Zones for Paris**

M. Jean Benedetti, Prefect of the Greater Paris area, has selected two districts of the city as "smokeless zones" in an experimental campaign. The districts are in complete contrast —the residential 16th arrondissement in the west and the 11th arrondissement in the east which is made up of working class homes and small workshops and factories.

Because of the number of homes with coal fire heating the 16th is considered the worst in the city from the point of view of pollution.

Residents in both districts have been asked to fill in a form indicating the type of heating equipment they employ. They have also been issued with instructions on how to limit smoke.

*Japan*

**Removing Sulphur Fumes**

Hydrogen Sulphide, $H_2S$, the compound so frequently and undesirably found in the waste gases emitted from chemical plants, may be oxidized and converted into sulphur, a useful chemical, using what has been claimed by the Osaka Gas Company to be a new, simple and economic process.

The gas, mixed with air at room temperature, is brought into intimate contact with an organic catalytic solution, and the sulphur so formed is removed either by filtration or by skimming off the sludge that floats on the surface of the liquid. The catalyst can be almost any nitrated phenol; the example quoted by the company is picric acid.

The process could have considerable advantages if it were linked with one of the well-known processes for extracting hydrogen sulphide from coal or producer gas and subsequently discharging it into the atmosphere.

# SMOKE CONTROL AREAS

## Progress Report

### POSITION TO MARCH 31st, 1961—TOTALS

| | England and Wales | Scotland |
|---|---|---|
| **Smokeless Zones** (Local Acts) in Operation .. | 44 | 1 |
| Acres, 3,400 | | |
| Premises, 41,060 | | |
| **Smoke Control Areas in Operation** .. .. | 271 | 10 |
| Acres, 37,251 | | |
| Premises, 244,864 | | |
| **Smoke Control Orders**— | 209 | 8 |
| Confirmed .. .. .. .. .. | 131 | 7 |
| Submitted .. .. .. .. .. | | |
| **Grand Totals** .. .. .. .. | 655 | 26 |

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Spring, 1961), which gave the position up to December 31st, 1960. They now show the changes and additions to March 31st, 1961.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

### ENGLAND AND WALES

#### New Smoke Control Areas in Operation

Aldridge U.D. No. 1, *Altrincham B. Nos. 1 to 3, *Exeter C.B. Nos. 1 and 2, Wallesey C.B. No. 4, Wilmslow U.D. Nos. 1 and 5, Winsford B. No. 1.

#### New Orders Confirmed but not yet in Operation

Aireborough U.D. No. 6, Barking B. No. 1, Barnes B. No. 1, Beckenham B. No. 1, Beeston and Stapleford U.D. No. 1, Bermondsey M.B. No. 3, Bethnal Green M.B. No. 2, Birmingham C.B. Nos. 11 to 20, Brentford and Chiswick B. No. 2, Brighouse B. No. 2, Burnley C.B. No. 1, Bury C.B. No. 2, Croydon C.B. No. 3, Dukinfield B. No. 1, East Barnet U.D. No. 2, Eccles B. No. 1, Enfield B. No. 2, Finchley B. No. 5, Fulham M.B. No. 4, Halesowen B. Nos. 1 and 2, Harlow U.D. No. 1, Hayes and Harlington U.D. Nos. 9 and 15, Heywood B. No. 2, High Wycombe B. No. 9, Irlam U.D. No. 1, Kingston-upon-Hull C.B. Nos. 4 to 8, Lancaster B. No. 1, Manchester C.B. No. 2, Middleton B. Nos. 2 to 6, Mirfield U.D. Nos. 1 and 2, Morley B. Nos. 1 to 7, Newburn U.D. Nos. 1 and 2, Northfleet U.D. No. 1, Poplar M.B. Nos. 1 to 6, Reading C.B. Nos. 4 and 5, St. Marylebone M.B. No. 4, St. Pancras M.B. No. 3, Sale B. No. 2, Selford C.B. No. 1, Sheffield C.B. No. 7, Shoreditch M.B. No. 2, Stockport C.B. No. 2, Stoke Newington B. Nos. 6 and 10, Stoke-on-Trent C.B. Nos. 1 to 6, Stretford B. No. 1, Swinton and Pendlebury B. No. 2, Walsall C.B. Nos. 1 to 3, Wandsworth M.B. No. 3, Wanstead and Woodford B. No. 2, Warrington C.B. Nos. 3 and 4, Wembley B. No. 1, Westminster M.B. Nos. 4 and 5, Whitefield U.D. No. 2, Widnes B. No. 1, Willenhall U.D. Nos. 7 to 9, Wood Green B. No. 3, Woolwich M.B. No. 10, Wortley R.D. No. 4.

#### New Orders Submitted for Confirmation but not yet Confirmed

Aireborough U.D. No. 9, Barnes B. No. 2, Barnsley C.B. No. 3, Bebington B. No. 2, Beckenham B. No. 1, Birkenhead

C.B. No. 1, Birmingham C.B. Nos. 7 to 9, Bredbury and Romiley U.D. No. 2, Brighouse B. Nos. 3 and 4, Chatham B. No. 1, Church U.D. No. 2, Crayford U.D. No. 1, Crewe B. No. 1, Dewsbury C.B. No. 5, Ealing B. No. 6, Eccles B. No. 2, Ellesmere Port B. No. 4, Gateshead C.B. No. 3, Halesowen B. No. 3, Halifax C.B. Nos. 4 and 5, Hammersmith M.B. No. 3, Harlow U.D. No. 1, Hebburn U.D.C., Heckmondwike U.D. No. 2, Hindley U.D. No. 1, Holborn M.B. No. 4, Hornchurch U.D. No. 3, Hornsey B. No. 3, Huyton-with-Roby U.D. No. 2, Keighley B. No. 1, Kingston-on-Thames B. No. 1, Leamington Spa B. Nos. 9 and 10, Leicester C.B. No. 6, Lewisham M.B. Nos. 8 and 9, Marple U.D. No. 1, Middlesbrough C.B. No. 2, Middleton B. Nos. 7 and 8, Newcastle-upon-Tyne C.B. Nos. 3 and 4, Oldbury B. No. 1, Paddington M.B. No. 3, Pudsey B. No. 2, Reading C.B. Nos. 6 and 7, Rochdale C.B. No. 3, Sale B. No. 3, Scunthorpe B. No. 2, Sheffield C.B. No. 8, Slough B. No. 1, Southall B. No. 3, Southampton C.B. No. 1, Southwark M.B. No. 1, Stalybridge B. No. 5, Stoke Newington M.B. No. 6, Thornaby-on-Tees No. 1, Urmston U.D. Nos. 1 and 2, Willesden B. No. 3, Wolverhampton C.B. No. 1, Yiewsley and West Drayton U.D. No. 2.

### SCOTLAND

**New Smoke Control Areas in Operation**

Edinburgh Central No. 1.

**New Orders Confirmed but not yet in Operation**

Dundee Nos. 3 to 5, Glasgow No. 5.

**New Orders Submitted for Confirmation but not yet Confirmed**

Dumbarton Nos. 3 and 4, Edinburgh (Sighthill No. 3), Glasgow No. 6, Motherwell and Wishaw No. 1.

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## Sir Roger Duncalfe

We regret to report the death at Bournemouth on April 15th of Sir Roger Duncalfe, who was Deputy Chairman of the Beaver Committee. Sir Roger, who was 76, was a Vice-President of the Federation of British Industries and had been President of the British Standards Institution. In business Sir Roger was Chairman of British Glues and Chemicals Ltd. from 1946 to 1957.

# *Clean Air In The Future*

Mr. W. K. Hutchison, C.B.E., Deputy Chairman of the Gas Council, recently gave an imaginative address to the Fuel Luncheon Club in London. He cast himself in the role of a future historian writing twenty years hence, thus commenting from afar on recent history and prophesying on the near future. On clean air he said:

" The first faltering steps towards a genuine Clean Air policy having by 1973 eliminated the impurities visible as smoke, the outstanding success of this operation only made more insistent the demand in all our big cities for even higher standards of purity. The elimination of sulphur acids became obligatory and the Ringelmann Chart was discarded in favour of an infra-red sulphur acid detector. First the small and later the larger offices and hotels were glad to follow the example of the domestic consumer and change over to gas."

Commenting on the gas industry itself around 1960, Mr. Hutchison made his historian say: " Among the reasons for what seems now to have been lack of enterprise, was an anxiety that at no time should the peak load exceed the capacity to meet it, and a desire to maintain a balance between the sales of two main products. Did no one realize how long it takes to build up a new load, from the time that the effort is first made?

" Publicity in a two-fuel industry," continues the historian, " is always subject to a kind of schizophrenia unless it is realized that each product must be sold on its merits, neither fuel pulling its punches in the interests of the other. If, as a result, sales of the two products are out of balance, the remedy is to be found in new processes even if this means abandoning existing processes and traditional raw materials."

# *Motor Vehicle Pollution in U.S.A.*

## DISCUSSION ON MR. HARROP'S PAPER

THE Paper by P. J. Harrop, of the Ministry of Housing and Local Government, published in our last issue (Spring, 1961, pp. 174–188) was presented and discussed at a meeting of the Society held in London on March 24th, 1961.

The Chairman of the Executive Council, John Innes, presided, and with him on the platform, in addition to Mr. Harrop, were J. E. Beddoe and P. D. Coates of the Ministry of Housing and Local Government, Stanley E. Cohen, Hon. Treasurer, Dr. J. L. Burn and James Goodfellow, Deputy Chairmen, Norman Bastable, Chairman of the South East Division, and Arnold Marsh, Director.

Following the Chairman's introductory remarks Mr. Harrop spoke on his paper, as printed, and the meeting was then open for discussion and questions.

The discussion was opened by **Douglas Lister** (County Health Inspector, Northumberland) who began by saying that his impression of motor vehicle pollution in America had always been, and Mr. Harrop's paper had confirmed his belief, that with regard to air pollution by smoking diesel-engined vehicles we could not learn a great deal from the States. When it came to chemical pollution from petrol engines there was a great deal that we might learn, but as far as he could see, not much that was likely to be of use to us in the foreseeable future. He suggested that we should not pay too much attention to Los Angeles smog although it was very interesting. The trouble with Los Angeles was that a community had become established there of some six million people, owning collectively some three million automobiles, in a region where, for topographic reasons, there was a chronic shortage of fresh air. After reading some of the literature on the subject, of which there was a great deal, he had the impression that urgent though the problem appeared, the Californians were secretly rather proud of Los Angeles smog. It was a unique problem, the biggest thing of its kind in the world, and he thought that it was almost becoming identified in some way with the American way of life. He thought that if ever it was overcome, it would be missed.

Mr. Lister said that it seemed from Mr. Harrop's paper that Americans felt that they were making some progress, but they had felt this for the last five years, to his knowledge, although they had not yet reached a solution. They had just passed a law making it compulsory to fit after-burner devices, before such a device had been approved —and this was their position at the moment. Mr. Lister suggested one way of alleviating the problem, although he knew that his advice was vain: that they substitute British or Continental made cars with engines one-third the size of their gargantuan American automobiles. This might not solve the problem, but would at least help. The fact was that petroleum was far too cheap in America, and that inefficiency in its utilization was tolerated on a large scale, which was one of the reasons for the trouble they had with smoke from private cars. For the same reason the efficiency and economy of the diesel engine had never been a selling point in the States to the extent that it had in this country. As a result the proportion of diesel fumes from petrol in Los Angeles was about 1 to 36 compared with 1 to 4 in this country. Our trouble from invisible pollution as far as he could see, really arose when there was congestion of traffic. Petrol vehicles edging forward in a traffic jam not only failed to dissipate their exhaust gases by normal movement, but produced about 9 times as much carbon monoxide and up to 20 times as much hydrocarbon pollution because of that intermittent operation.

Mr. Lister knew that in speaking in this way to Mr. Harrop he was talking to the wrong Ministry. He could see no great need in this country for exhaust control devices, and notwithstanding his personal enthusiasm for clean air, as a motorist he would be reluctant to fit any of the existing devices to his car. The important part of Mr. Harrop's paper, as far as he was concerned, began on page 184—smoke from motor vehicles—where he quoted two authorities, the State of California, and Detroit, where air pollution inspectors were helping the police in dealing with offending vehicles. Cincinnati had found it possible to refer offending vehicles to its vehicle inspection service. He gathered that the District of Columbia was doing something similar. He had often spoken of Durban, in South Africa, in the past, and now it seemed that Belgium was taking action too. He now asked our Ministry of Transport how many other countries would do this before we considered it as a serious proposition. Mr. Lister said that he endorsed all that Mr. Harrop had said in para. 81. He would go further than Mr. Harrop had done in saying that afterburning of diesel exhaust would be difficult. In practice, and he had had experience of this, it was in some cases impossible, and exhaust treatment devices were not the answer to diesel smoke. Finally, Mr. Lister qualified the statement in para. 83, that propane powered engines were free from obnoxious exhausts. Referring to the work done on this by the American Air Pollution Foundation in 1955, he said that although there might be some reduction in carbon monoxide, and there was probably far less smell, because of the modifications in the aldehyde content, the chemical composition of exhaust gas was not otherwise greatly different from those of petrol engined vehicles.

**Councillor F. W. Marshall** (Leyton) began by saying that he was pleased to have an opportunity of raising the point about smoke, particularly in relation to diesel driven vehicles. Purely from the health aspect, and knowing the hazard to health from these particular pollutants he felt that it was time to look into the matter most seriously. It appeared that respiratory diseases, etc., were increasing, and thinking of diesel fumes, etc., being poured out at a low level, one wondered what was their effect on the human frame. He knew that some local authorities had had roundabouts, with flowers growing at a very low level, which had been killed off by the pollutants. The roundabouts had had to be raised to escape the exhaust fumes. If this was their effect on plants, what could it be on our lungs?

He felt that the medical profession must tackle the question seriously. As a layman he might be treading on dangerous ground, but from information which he had collected over the previous year, he had found that three people in his area who had had connections with diesel fumes and diesel oil in its crude state, had contracted cancer and died. This might be pure coincidence. Another point that he could speak on from experience as a railway worker, was pollution from diesel fumes, particularly on the railway. Diesel fumes emitted close to glass, penetrated the glass, and could not be extracted.

**A. T. Wilford** (London Transport Executive) said that his object in speaking was to remind other speakers that four-fifths of the paper deal with petrol engines and about one-fifth with diesel engines. As usual, people were talking about visible pollution rather than invisible pollution. The engineers of London Transport were trying to make a source of visible pollution invisible, and from that point of view it could be claimed that their diesel-engined buses were no worse, and were in fact a lot better, than petrol vehicles. When it came to carbon monoxide, while the good petrol vehicle on Californian standards must not have more than 1·5 per cent. carbon monoxide in the exhaust gases, the bad petrol vehicle in England, and probably in the U.S.A. too, might under adverse conditions have as much as 9 or 10 per cent. of carbon monoxide.

An ordinary diesel engine in this country, except for those emitting black smoke, would have possibly 0·02–0·07 per cent.—very small amounts. Thus the diesel engine, when properly maintained and operated, was much better than the petrol engine in that respect. It was interesting to note that from tests recently made by London Transport it was found that, in a portion of their tunnels where diesel engined locomotives and steam locomotives were operating as well as electrified stock, the amount of carbon monoxide in the air when the diesel locomotives were travelling through was appreciably less than when steam locomotives were passing through.

**T. Henry Turner** (Individual Member) said that he had been asked to raise a point by a lady who took out her child in a push-chair. She asked whether the Society knew that the exhaust fumes from a London bus, or any bus, issuing sideways at low level in one-way streets, were frequently going directly into the face of a child in a push-chair. The question of where the exhaust should be placed had been passed over time and again. Mr. Turner asked the meeting to consider where atmospheric pollution from exhaust pipes in the streets went. If it were gaseous, it must finally rise, yet we directed it downward. If one stood at the top of Hill Street in Birmingham where the buses were working hard to get up the hill and then take a right-hand turn, one's trousers were almost blown off by the exhaust which came out sideways. The same thing happened if one stood at the corner of Bond Street and a bus came round from Piccadilly. He said that we were aware of this, that it was a nuisance, but we did not do anything about it, but that it was an eye-opener to find that the exhaust was actually going into the faces of children in their prams. He asked Warren Spring Laboratory, the road safety research section at Langley Hall, the Ministry of Transport and motor manufacturers to make large-scale tests of a vertical exhaust. It was quite ridiculous to say that it could not be done. Agricultural tractors, long-distance trucks in America, and most military vehicles had them, and it was said that we could not have them in London, as it would poison the people on tops of buses. At present we were poisoning those at ground level. If the main problem was to get rid of the exhaust from buses, we should begin at once. He asked that the possibility of getting rid of it, high up, be tested intensely, on a few hundred buses, a few hundred lorries, for there was no reason why much of the difficulty of passing a diesel truck emitting smoke on the off-side should not be eliminated, if that black smoke were emitted at 6 or 8 feet up in the air, when we should be able to see past the vehicle. Many accidents could be prevented merely by that different emission of the exhaust smoke.

**P. Draper** (Shell-Mex & B.P.) began by saying that this was a very complex subject, and that his Company had taken great pains to try and discover what had been happening in Los Angeles, and that his parent Companies had provided them with information in the matter. He felt that Mr. Harrop's paper was a classic on the subject. He had one question to put to Mr. Harrop with regard to smoke from petrol engines. It had been said that in the number of summonses which occurred the offenders were 2:1 private, as against commercial. Very few people in America were operating diesels, so that meant that a larger number of people were pulled up for making smoke with petrol engines. The point was, to ask if the smoke from petrol engines was really combustion smoke, or lubricating oil smoke, due to the condition of engines. He felt this to be an important question, as smoke from lubricating oil would give a different analytical result from smoke from combustion. It was nearly always smoke from lubricating oil which we saw in this country, because the engine needed a re-bore. It was rare to see smoke from fuel, and when one did it was usually because the driver had

left the choke out for a short time. Could Mr. Harrop say whether those cases were likely to have been due to lubricating oil?

**Dr. Craxford** (Warren Spring Laboratory) in reply to Mr. Turner said that Warren Spring Laboratory were examining the question of vertical exhausts pipe for diesels. He said that they had made a piece of film comparing the obscuration of view encountered with vertical exhaust, with the exhaust in the normal place. He was sorry to say that they were not doing it with a few, or hundreds of lorries, but with one.

**Councillor W. A. N. Jones** (Birmingham) said that what Mr. Harrop had said on the question of motor vehicle pollution was true not only of America, but of our congested island too. The existing menace on the roads, to public health and safety was growing and would only continue to grow with the increasing numbers of vehicles on our roads. He felt that this growing problem must be tackled seriously, whether here or in the U.S.A. He asked the scientists and those in industry and commerce why we must tolerate the situation, and why they could not remove the pollutants at their source? He spoke of the use of catalysts, and the D.S.I.R's. experiments with them, and said that their experiments had shown that there was not a successful catalyst to solve the problem. He believed that the gases which now polluted the atmosphere would eventually poison us, and that unless it were possible to remove the pollutants at source, we should have to find some other mineral form, or some other type of propulsive method.

**Dr. P. J. Lawther** (Medical Research Council) began by congratulating Mr. Harrop on his excellent paper. He said that only one question was posed in it, which he would like to answer, and that was that they were looking at carbon monoxide, and were aware of its toxicity, and that he was in continuous consultation with Dr. Goldsmith in Los Angeles on the formulation of permissible community air standards and they would be devoting this summer largely to the examination of that pattern.

**Miss D. Boyd** (Individual Member) said that she had read Mr. Harrop's paper with great interest. She had heard the arguments for after-burners from the scientific viewpoint, and it seemed to her, from the practical point of view, that it would be much better if our vehicles were designed so that they consumed the source of their power efficiently before the waste products were put into the air. She had been very interested in Mr. Lister's paper at Harrogate, when he had outlined the methods being taken in Durban to withdraw vehicles, diesel vehicles in particular, which were polluting the air. Miss Boyd said that against that statement she had considered Dr. Lawther's statement, when he said that the only acceptable means of traction in coal mines was diesel engines. Thus it seemed to her that it was possible to maintain diesel engines at a high rate of efficiency, and she would therefore suggest that the traffic wardens should supplement the work of the police, who had in the last few years obtained convictions where vehicles were badly maintained, and had succeeded in removing such vehicles from the roads. Diesel engines were undoubtedly effective, but let everyone who saw an offending vehicle report it, and thus maintain the efficiency of the diesel engine to the maximum. Offenders should be removed from the road until they had a clean bill, this would not offend those who kept their engines in a good state, and would help towards the clean air we all wanted so much.

**A. G. Atfield** (Dunedin Engineering Co. Ltd.) said that the paper and the discussion had been very interesting, and that he would only like to add a few words on the condition of diesel engines, and the main cause of diesel smoke. Diesel smoke could be cured. It was purely a matter of good maintenance and a number of big fleets in this country were already carrying that out. It was cheap and simple. It would be advertising to state the name of these fleets, but they could be seen

by the condition of the vehicles. It was not much use putting the exhaust pipes upwards, because black smoke consisted mainly of solids, and the solids only came down again. The thing was to cure the trouble at the start, and also to eliminate the aldehydes and the $NO_2$ from the start. Catalysts were cumbersome and ineffective, and as the meeting had heard, had not yet been effectively designed. As a general rule there was no need for them. Petrol engines were a different subject, and he was afraid he was not equipped to speak upon that.

**Councillor J. D. Gorden-Lee** (Hendon) said that as Chairman of a Public Health Committee of a borough on the outskirts of London, which was much concerned with traffic problems, and also as an employee of one of the major oil companies, he saw something of both sides of the problem. The public was very concerned with what it saw, and that was why the public became so concerned over the emission of diesel fumes. Those who had attended the Conference of Public Health Inspectors the previous year would have heard a medical expert in one of the main lectures explain that the medical effects from diesel fumes were not as great as the public often believed, and in fact as some members of this meeting had asked them to believe. Nevertheless, the public was not necessarily satisfied by that sort of assurance. They did not want to see smoke, because whether it was medically dangerous or not, it could still be a public nuisance and a road safety danger.

In Hendon it was their practice, when a vehicle was seen emitting smoke, to take the registration number and communicate with the owner. It might be thought that the British public was unresponsive to appeals, but the facts were to the contrary. In the first six months of running this scheme they had found that almost 90 per cent. of the people observed had replied. Only one reply had been at all abusive, and in almost every other case they had been thanked for drawing the matter to attention. Furthermore most of the replies were signed by the most responsible people in the firms concerned. He thanked Mr. Harrop for his paper, and said that he felt that this sort of co-operation was commendable, as it could have an effect more quickly than legislation could do. It did not, however, cover non-visible emission; but the technical people who produced this could do so much to rid us of it.

**S. C. Vince** (Public Transport Association) said that he represented a body of transport vehicle operators covering up to 25,000 vehicles, who did strive to keep their exhausts clean. He felt that responsible operators did not fear police action, and that if they were summoned would put what was wrong right, because vehicles were only mechanical devices, which could break down, although the operators did their best. Referring to regulations on the subject of smoke, he thought that they were ambiguous, the American ones too. He cited an example: In Cincinnati they spoke of unreasonable amounts of smoke, of unnecessary amounts, etc., but without defining such amounts. Where was the border line? An earlier speaker had spoken of the effect of exhaust fumes from diesels on health. He felt that the medical profession had gone closely into this, and had given diesel engines a pretty clear report. He believed that the three people who had died, who had been associated with diesel fuel or fumes, would have died even without such associations. For many years he had been involved in the running of diesel engines. He had been in garages where there was such dense smoke in the mornings when engines were being started, that one could not see across them, yet he had never known an individual employed by such a company to go down with such a complaint. He felt therefore that this was just a red herring, introduced by certain people who did not like diesels.

**E. Woodbridge** (Society of Motor Manufacturers and Traders) began by congratulating Mr. Harrop on his excellent paper and said that there was

only one point he wished to make, which was that he was surprised that no one had mentioned the excess fuel device, which in addition to bad maintenance was one of the chief causes of black smoke. Reference had been made to the Ministry of Transport's inactivity, but the Ministry had recently issued a draft regulation which would make it compulsory for the excess fuel device to be inaccessible to the driver. Before that, many manufacturers had already made the device inaccessible to the driver, and in some cases operation was automatic. By a strange coincidence, in the same week that the Ministry of Transport issued this draft regulation, a motor transport journal which had a regular feature awarding prizes for bright ideas, gave a prize to a man who sent in a method whereby, by drilling a hole, he could tamper with the excess fuel device!

**Mr. Harrop,** replying to the discussion, made the following comments.

Mr. Lister had suggested that the Californians were secretly proud of their smog but his impression in Los Angeles had been that its citizens would rather be without the honour. Certainly the City's Air Pollution Control District had been doing all it could to conquer smog. Mr. Lister had also underlined the point that much of the heaviest concentration of pollution, particularly carbon monoxide, was due to the congestion of traffic. That was so. The conclusion one could draw was that there should be an extra dividend from road improvements in the way of cleaner air. As for the reference in the paper to propane engined vehicles as "free from obnoxious exhaust," he rather agreed that the statement went a bit far. Some figures of emissions from diesel, gasolene and propane engined buses in Chicago were given in a report by three American research workers. The percentage emissions varied according to the different pollutants concerned but as a very rough and ready summary it would appear true to say that a propane engined vehicle came somewhere between a diesel and a gasolene driven vehicle in point of emissions of pollutants. With regard to Councillor Marshall's plea for more medical research into the effects of smoke, particularly from diesel engines, Mr. Harrop pointed out that Dr. Lawther of the Medical Research Council had been studying the effects of diesel emissions for some years and was shortly to publish further work on the subject. Dr. Craxford had already given Mr. Turner a partial answer to his request for experiments in the vertical discharge of vehicle exhaust: a small experiment was in progress at the Warren Spring Laboratory of D.S.I.R. The Clean Air Council for Scotland had also taken an interest in the idea but at the moment the case for vertical discharge was unproven.

Turning to the ratio of prosecutions in Detroit between private and commercial vehicles, Mr. Harrop said he did not know why twice as many private vehicles, presumably automobiles, had offended. Like Mr. Draper, he thought that their smoke was probably due to the burning of lubricating oil and not to the combustion of petrol.

Dealing with the tasks of education and enforcement, Mr. Harrop thought that Miss Boyd's valuable suggestion that the traffic wardens might be used to supplement the police in dealing with smoke from vehicles was worth considering. So too was the practice of Hendon, described by Councillor Gorden-Lee. If more local authorities got their Public Health Inspectors to note cases where vehicles were emitting smoke and to follow these up with the owners, then a great deal could be done. It was very encouraging that Hendon had had replies from the owners of these vehicles acknowledging their fault and stating their readiness to try and do better.

Finally, he congratulated Mr. Woodbridge on reminding the meeting of what was really the latest piece of news on the exhaust front—the Ministry of Transport's draft regulation requiring the excess fuel device to be placed out of the control of the driver in his cab.

# IMPROVING SMOKELESS FUEL SUPPLIES

## *N.C.B. Plans Outlined*

PLANS for improving, increasing and widening the range of solid smokeless fuels and the steps being taken to develop new labour saving appliances and a better standard of service were described in London by Mr. Derek Ezra, the National Coal Board's Director-General of Marketing in a speech to the Women's Advisory Council on Solid Fuel in London on March 16th, 1961.

It was not only legislation but public preference which was stimulating the demand for smokeless fuels, and this demand was by no means restricted to Smoke Control Areas, said Mr. Ezra. The Beaver Report had proposed that some 19 million tons of bituminous coal burned each year for domestic purposes would have to be replaced by smokeless fuel during a period of 10 to 15 years. In the five years since the Clean Air Act was passed about 470 smoke control areas had been confirmed involving a demand for only three-quarters of a million tons or so of smokeless fuel. One of the reasons given by some Local Councils for not proceeding faster with Smoke Control Areas was the apparent lack of satisfactory smokeless fuels said Mr. Ezra. The Beaver Report had assumed that the brunt of the conversion from bituminous to smokeless fuels would be taken by gas coke, but consumers in many parts of the country were expressing a preference for the "premium" fuels, (such as Coalite, Rexco, Cleanglow, and Phimax) produced by the Gas Industry and other producers. The amount of these fuels was not yet sufficient to satisfy the public demand, even though the tonnage has been increasing in line with the indications given in the Peech Report (from about 750,000 tons in 1958 to an estimated 1½ million tons in 1961). It was reasonable to assume that the producers of these fuels would continue to add to their outputs in the next few years. The Coal Board would also be making a major contribution.

The Board's hopes lay, said Mr. Ezra, in the new smokeless fuels for the open fire which had reached the pilot plant stage in the Midlands and in South Wales. The main process being developed was revolutionary, and could be applied to a large range of the coals produced in this country. The Board were now at the point of distributing products of the pilot plants for market trial, and had put in hand design work for building commercial scale plants. The Board hoped, said Mr. Ezra, that within two to three years the products of the first plant would be reaching the market in fair quantity, and by 1965, when other commercial plants would be getting into their stride, the output of smokeless fuels will have topped the million mark.

The Board were confident that their new fuel would meet entirely the requirements of the Clean Air Act, and they would thus be able to play their part in attaining the objectives laid down in the Beaver Report with a fuel which was still in the early research stage when that Report was prepared. Mr. Ezra then went on to emphasize that the problem of finding a substitute fuel for the open fire should not be allowed to mask the development which was taking place in other forms of domestic solid fuel heating and he referred to the important contribution which could be made by the openable or closed stove. The Board were aware of the preference which existed in

favour of the open fire, but the new types of stoves, particularly the openable kind with glass doors or shutters which were so attractive, should appeal to most housewives. These stoves had two advantages of great importance; they were more efficient than even the improved varieties of open fires; and they could burn a much wider range of smokeless fuels, including the Board's special boiler coke which was now marketed under the name of " Sunbrite ".

It was a great disappointment that local authorities, when making grants in Smoke Control Areas did not extend these to cover the purchase of heating stoves. He hoped that some local authorities might be prevailed upon to take a more generous view of the matter and went on to suggest that householders undertaking conversions in Smoke Control Areas should be encouraged to purchase these stoves through the Board's Housewarming Plan, and use the grant they received from the local authority as a first instalment.

Turning to other forms of heating Mr. Ezra said that the Board were convinced that they would be able to channel a large part of the growing interest in central heating in the direction of solid fuel.

The Board now marketed about $2\frac{1}{2}$ million tons a year of various sorts of boiler fuel. Year by year they would be adding to these tonnages. The big new anthracite pits in South Wales were now producing; more " Phurnacite " was being made; there would be plenty of Sunbrite; and they were conducting experiments with Anthracite Duff and should be able to produce a satisfactory and long lasting fuel from that product.

The Board were not limiting themselves to the provision of the fuels required for domestic boilers. They had also taken steps to ensure that boilers which make the best use of fuels, and provide the consumer with the greatest degree of reliability and convenience, would be developed, and this, he explained, meant meeting the challenging problem of devising a solid fuel boiler which would be as easy to run, as automatic, and as labour saving, as the boilers currently marketed for oil firing. By the next heating season a number of the new boilers would be available to the public with novel features which would considerably cut down labour in the home. Further big strides would be taken in the following year and he was convinced that ultimately the domestic consumer would be able to obtain a solid fuel fired boiler which would involve no more labour than simply turning on a switch, and adjusting one or two controls. This, said Mr. Ezra, was not science fiction; it was just around the corner.

Mr. Ezra's final point was about service to the consumer, about which the domestic Coal Consumers' Council had recently expressed some firm and constructive views. The Board and the Trade had been holding discussions to devise a standard of service throughout the retail coal trade, whatever the size of the business and wherever operated. The Board did not wish to ignore the high standards which many merchants had developed in recent years but the aim of this joint endeavour was to spread these standards as widely as possible in the interests of the consumer—whose custom both the Board and the coal trade were anxious to keep.

Mr. Ezra paid tribute to the work of the Women's Advisory Council on Solid Fuel, and indicated how helpful this was to the Board and the Trade.

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## 50,000 DEATHS A YEAR

Mr. Henry Brooke, Minister of Housing and Local Government, opening a Clean Air Exhibition at Bristol on May 15th said: " It would seem an odd thing if men can traverse space and yet not be able to get rid of smoke and grime in everyday life. Smoke and dirt kill 50,000 people a year. But science was showing how to get the air clean. The only question is whether we are willing to take the trouble. I say we must."

# *Coal and the Clean Air Act*

An Address to the North East Division, N.S.C.A.

**by**

**J. S. Williams, O.B.E.**

*Deputy Director of Marketing, National Coal Board*

MAY I start by saying right away that it is the declared policy of the National Coal Board to give all possible support to the implementation of the Clean Air Act. As a public organization, we in the Board are bound to support what Parliament decides, even though the legislation is permissive so far as local authorities are concerned.

But quite apart from being a public organization, we are also a commercial body, and the Act can have quite a substantial impact on the business aspect of our activities. Nevertheless, we must welcome the idea of clean air from every point of view. So far as the coal industry is concerned, it is a challenge—an opportunity to show that we too can align ourselves with a progressive movement, and an opportunity to show that coal, one of the oldest fuels, can be as modern as the rest.

**Industrial**

We started off badly in the industrial field by the preference that was given to oil burning appliances under the Exempted Fireplaces Order of 1957. This order really put oil in the same class as the "authorized fuels" and tended to give the impression that oil was the only fuel which would enable industrialists to comply with the Clean Air Act. In considering "Prior Approval" for new furnaces under Section 3 there is no doubt that many local authorities were influenced by the Order. This was particularly true when considering new installations to be located in premises which would ultimately be in smoke control areas. The Order certainly put oil in a more favourable position than coal and for a period of two years after its introduction the case for exemption for the use of automatic stokers burning bituminous coal in smoke control areas had to be made specifically in each case to the local authority. While a few local authorities were prepared to grant exemptions to such plant, the majority were not. This put coal at a great disadvantage in competition with oil, in what was becoming a highly competitive market, and left an air of uncertainty in the minds of customers who might otherwise have preferred to put in modern coal-fired equipment.

The Smoke Control Areas (Exempted Fireplaces) Order, 1959, which came into operation on July 17th, 1959, however, has rectified this anomaly. This Order recognizes that bituminous coal can be burned with the degree of smokelessness required by the Act and gives automatic exemption to mechanical stokers installed during 1957, or later, provided that they are so installed, maintained and operated as to minimize the emission of smoke and that no other fuel is used than that for which the mechanical stoker was designed. The Ministry of Housing and Local Government have also indicated (in Circular No. 44/59 of July 16th, 1959) that mechanical stokers which were installed before December 31st, 1956, but which are capable of being operated in compliance with the Act should also be given exemption.

The exemption of mechanical stokers has been a great stimulus to the coal industry but it has also imposed upon us certain obligations and responsi-

bilities. While from a commercial point of view we are out to promote as widely as possible the use of mechanical stokers of the most modern kind especially in replacement of hand-fired plant, the exemption order lays particular stress on the right fuel and correct operation of the plant. These are points which of course are the direct concern of the Board.

**Technical Advisory Service**

It so happened that the exemption order coincided with the start of the Board's free technical advisory service, through which we now have over 70 qualified fuel technologists and stoker demonstrators available to help consumers all over the country. One of their tasks has naturally been to visit all consumers with hand-fired boilers to ensure that these are in due course converted to mechanical stoking—unless of course they are on hand-firing with a smokeless solid fuel such as hard coke. As you know, local authorities are at present prepared to grant temporary exemption certificates for hand-fired boilers but these will not be renewable after 1963. One of the tasks of our technologists is to persuade industrialists that the fitting of automatic stokers will not only result in freedom from worry about smoke emission, but will give such improvements in efficiency that the stokers will probably pay for themselves within two years.

We have been supporting this service with widespread advertising and with the distribution of technical publications describing the main types of mechanical stoking plant available. In a few weeks time we shall have available also a colour film on the various types of mechanical stokers.

When it comes to the right fuel for the job I think you would be interested to know that since vesting day the Board has spent over £50 million on the installation of something like 270 coal washeries and another 60 are planned or are in course of construction at an estimated cost of about £35 million. We are trying to take every possible step therefore to see that the right type of fuel is available for mechanical firing, but even this does not ensure that the right type of fuel is always chosen for a particular plant.

In a recent survey carried out by the National Industrial Fuel Efficiency Service it was found that 11 per cent of smoke emission cases were caused by the wrong fuel being chosen in the first place. Of 56 cases coming under some aspect of the Clean Air Act dealt with last year by the Northern Division of the Board, some 25 per cent. of smoke emission problems were due to the incorrect choice of fuel. This again is where our technical service is helping to ensure that the care we take to prepare the fuel properly is not wasted by the wrong quality being chosen for the plant concerned.

The exemption order underlines the need for correct operation of the plant and here again both the N.I.F.E.S.' investigation and our own local surveys have shown that usually over half the smoke emission cases were due to poor operation, usually by unskilled staff. We have had considerable success in curing these cases by proper instruction of staff on operational details and by ensuring a proper understanding of the principles of correct combustion.

**Development Work**

In parallel with the operation of our technical service we are undertaking a great deal of development work with research organizations such as the British Coal Utilization Research Association and with stoker and boiler manufacturers in an endeavour to produce mechanically fired plant which will be as cheap in capital cost as oil plant and certainly cheaper in running costs. The sort of things that we are investigating in particular are the completely automatic operation of plant, mechanical handling of both coal and ash to and from the plant and the development of the small chain grate type of stoker for burning cheaply and smokelessly the smaller

types of coal which are in plentiful supply. We are making good progress in all these directions and I can only feel that the Clean Air Act has been a real stimulus to our efforts in this direction.

While still on the industrial side, may I say that our own colliery plants are making a substantial contribution towards cleaner air. If you take the Northumberland pits alone, only 10 out of a total of 48 remain on steam winding—all the others have been electrified. Six out of the 10 on steam winding are still hand-fired, but all 10 will be electrified over the next few years. Of the 36 collieries with boilers for pithead baths, canteens and space heating, only 4 are still hand-fired. All these installations are the subject of routine surveys by the fuel efficiency section of the Divisional Scientific Department, so that we keep a pretty close eye on what we ourselves are doing by way of setting an example so far as clean air is concerned.

If I may summarize on the industrial side, I would say that there are plenty of good appliances already, and there will be even better ones; there is an adequate supply of the right type of fuel for these mechanical stokers. It is the National Coal Board's job through its technical advisory service, to act, as it were, as a marriage broker to ensure a good match between the two and good management of the two.

**Domestic**

The Board's position on the domestic clean air front is quite a clear one, but the circumstances surrounding it are rather more complicated. Although we are the suppliers of the 34 million tons of bituminous coal which (including miners' coal) still form nearly seven-eighths of the annual heat supply to our homes of this country, we attach great importance to, and support, the progress of clean air. We regard the problem of the supply of smokeless fuels for the domestic market as one of the most important aspects of our work.

First of all, for what sort of purposes are those fuels going to be needed? How do we see the pattern of future heating in the home? I think there are three clear "facts of life" which we must bear in mind. They are first that there is a general demand for more heat in the home. Secondly, that there is an ingrained love of the open fire which even the growth of central heating will not eradicate. Thirdly, that so far as smokeless fuels for the open fire are concerned, there is a clear preference on the part of the public for the more expensive premium fuels.

While there will undoubtedly be a limited extension of full domestic central heating, we see the main pattern of the future as partial background heating with two or three radiators and a towel rail, from a hot water boiler or even a large back-boiler open fire, and that this background heating will be supplemented by either an open fire or an openable stove in the living room. This presupposes, therefore, the sort of open fire appliance pattern which the Beaver Committee had in mind, plus a larger number of kitchen boilers which in turn will make increasing demands on the supply of smokeless solid fuels.

**Supply Position**

Let us take a look at the domestic supply position of smokeless fuels, first of all for the open fire. Beaver assumed that the brunt of the conversion from bituminous to smokeless fuels in the home would be taken by gas coke, but as I have already mentioned and as was shown by Bronowski in his paper to the International Clean Air Conference in London in October, 1959, the public are showing a marked preference for the "premium" fuels, produced by the Gas Industry and by other producers. Thus the limiting factor in meeting the public demand for smokeless fuels for the open fire today, is not so much the lack in any availability of gas coke, but the relatively restricted amount of premium fuels available.

The tonnage of premium fuels placed

on the market has been increasing in line with the indication given in the Peech Committee's Report from about 750,000 tons in 1958 to an estimated $1\frac{1}{2}$ million tons in 1961. I think it would be reasonable to assume that some or all of the producers of the existing brands of smokeless open fire fuels, such as Coalite, Rexco, Phimax and Cleanglow, will continue to increase their output. The Coal Board's contribution will be two-fold. In the first place we shall be making ever increasing efforts to provide the producers of premium fuels with the selected qualities of coal they need. Secondly, we shall ourselves be marketing increasing quantities of premium fuels. As a stop-gap measure we introduced "Warmco" which both last winter and this one has made a useful contribution to the public's need for premium fuels. However it is not our intention to pin our hopes for the future on an extension of the "Warmco" production. Our hopes lie in another direction altogether, namely in the new smokeless fuels which have at present reached the pilot plant stage both in the Midlands and in South Wales.

It may seem to you that we have been an inordinately long time in putting our new fuel on the market, but I am sure that you appreciate that as the main process being developed is a revolutionary one, and if as we intend we are ultimately to base several million tons of output upon it, it is obviously essential that the ground should be well prepared. We know that the process is technically quite feasible and that it can be applied to a large range of the coals we produce. We have already put in hand the design work for building commercial scale plants, which will have a capacity of about a million tons. We are also urgently considering whether other plants of a similar size can be established elsewhere than at Birch Coppice. We hope that within two or three years the products of the first commercial plant will be reaching the market in fair quantity, and by 1965 when other commercial plants will be starting to get in their stride, we hope that the output of these fuels will have topped the million ton mark.

I know that these long term prospects are not very much help to you up here in the North over your current problems, in an area which is mainly coal consuming and in which there is very little good open fire coke available. In fact I seem to remember that the Peech Committee singled you out for special mention, with a recommendation that openable stoves should be installed in this part of the world for burning locally produced hard coke.

I believe that in the National Society for Clean Air's North Eastern Region, the domestic consumption of solid fuel is about a million tons of coal, 200,000 tons of "Sunbrite" hard coke and about 100,000 tons of gas coke, anthracite and the premium fuels together. Of all this, just over 60,000 tons of bituminous coal will be replaced in the smoke control areas at present contemplated. It seems quite clear therefore that if smoke control is to be extended up here, there must be a drive, as the Peech Committee suggested, to popularize the very efficient and often quite attractive openable stove which has the advantage of course that it can burn a very wide range of smokeless fuels including "Sunbrite" hard coke, and is a good deal more efficient than the open fire.

It is a great disappointment to us at the Board that local authorities when making grants in smoke control areas, do not extend these grants to cover the purchase of heating stoves. We hope that many of you in the local authority field may be prevailed upon to take a more generous view in this matter, but in the meantime we would like to put a suggestion to you. We consider that householders should be encouraged, on undertaking conversions connected with the establishment of smoke control areas, to purchase heating stoves through the Board's Housewarming Plan, and to use the grant they receive from the local authority on the minimum type of conversion, as a first instalment. We would very

much like your support in getting this idea over to the public.

**Boiler Fuels**

Turning now to central heating, we are convinced that we shall be able to channel a large part of the growing load for this form of heating, in the direction of solid fuel. A word or two, therefore, about the smokeless boiler fuel position.

The Board at present market about $2\frac{1}{2}$ million tons a year of boiler fuels of various kinds of which the bulk is in the form of naturally smokeless fuels (anthracite and dry steam) from South Wales. There is also over 600,000 tons of Phurnacite made from dry steam coals and about half a million tons of specially selected "Sunbrite" hard coke, which of course is the most readily available boiler fuel in these parts. Year by year we shall be substantially adding to these tonnages. Our big new anthracite pits in South Wales are now producing, and this should put more natural boiler fuels on to the market. In the latter part of this year we shall be adding to the Phurnacite plant and bringing its total output up to 800,000 tons a year. We have more Sunbrite available, and are vigorously, and I think successfully marketing this product. Finally, we are conducting experiments with anthracite duff with the object of manufacturing a satisfactory and long lasting boiler fuel made from this product. Altogether, therefore, we consider that we shall have an adequate supply of boiler fuels, both natural and manufactured, to meet the rapidly increasing demand both for hot water and for central heating.

**New Appliances**

On the appliance development side you might be interested to know that in co-operation with some of the leading manufacturers, we have put in hand a programme of work in an endeavour to produce solid fuel boilers which are in every way as convenient and automatic as oil firing. This may seem an ambitious target but we are certainly within reach of seeing on the market next autumn greatly improved solid fuel boilers which will burn hard coke such as Sunbrite with the convenience and long burning characteristics that one normally associate with anthracite. We are going still further, however, and hope with our manufacturer friends to develop labour saving boilers, which will be provided with automatic control and even with automatic ignition, and I think it may be possible to have prototypes if not commercial models ready for next spring. Incidentally we are also pursuing with certain manufacturers improvements in the cleanliness and convenience of openable stoves in an endeavour to make them more popular.

One of the problems we are perpetually up against over the use of smokeless fuels, whether in smoke control areas or not, is the need for better fuel storage space. Smokeless fuels being bulkier, take up about twice as much space per ton as coal, and therefore unless adequate space is provided, need twice as many deliveries from the coal merchant. This is obviously one reason why their use is not so popular with the coal trade as they might be, and certainly one of the reasons for the difficulty of persuading the public to make more use of smokeless fuels. Those of you who are concerned with local authorities can set an example in this matter by providing really ample space in your new housing programme, and I would like to commend to you the booklet on *Fuel Stores for Houses and Flats* which is issued by the Coal Utilization Council.

Incidentally, the C.U.C. can help you in quite a number of other directions especially over technical problems, lectures, mobile exhibitions and publications, and it has a most useful information centre in Saville Row in Newcastle as well as in Leeds. I know that in the past there has been hesitation on the part of some local authorities in calling on C.U.C. services because of the advertising they have done for the open coal fire, understandably in view of the large

interest in the Council of the Coal Trade. I think you will be interested to know however, that at its last meeting the Council, with the agreement of the coal trade, decided as a matter of policy that in future its advertising would be directed not specifically to the coal fire, but to the *open fire* with coal or solid smokeless fuels. I hope you will see this, as I do, as a good and fair earnest of the Council's interest in all solid fuels, both coal and smokeless.

Having mentioned the C.U.C. I should of course also recall the services which I think most of you know about from the Solid Smokeless Fuels Federation, and also, for women's organizations, from the Women's Advisory Council on Solid Fuel. Between these organizations no local authority should be at a loss for speakers, exhibitions, technical advice and other services.

So far as Coal Board services are concerned, we are preparing a popular interest film in colour on Clean Air, intended for showing to the general public, and we shall be delighted to lend you copies free of charge as soon as it is ready, which should be early in May. Through our Housewarming Plan credit scheme we are also encouraging the sale of modern appliances, and it is only those on the C.U.C./S.S.F.F. approved list, all of which are capable of burning smokeless fuels, for which we allow these credit terms to be used. Incidentally, we too are opening advisory centres in those areas where we trade in the retail business, and I would strongly recommend a visit to our Newcastle Showroom to see examples of the latest equipment, both domestic and industrial.

In conclusion, I hope I have given the impression that we at the Coal Board are out to be as helpful as possible over the introduction of Smoke Control Areas. We ourselves have a very large stake in smokeless fuels and so long as the orderly development of Smoke Control Areas goes ahead in line with local smokeless fuel availability, that development will have our full support.

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*Reviews*

# FUEL, IRON AND STEEL, AND BOILERS

**Fuel Economy 1961. Published by the Federation of British Industries. 158 pp. 7s. 6d. net.**

This year's edition of this annual review devoted to fuel efficiency contains a useful article on the incineration of industrial wastes, by Mr. E. S. Hobson, Chief Engineer of Heenan & Froude Ltd. Mr. Hobson deals with the possibility of the disposal of wastes by municipal incineration (he also mentions controlled tipping), and by the individual industrialist installing his own incinerator. He also makes the interesting suggestion that a number of neighbouring factories could install a common plant.

The review also includes articles by Sir John Charrington on " The Distribution of Fuel to Industry," by Dr. Townend on " Coal and Science," and by Mr. E. Brett Davies on " Control of Corrosion Caused by Flue Gases."

**British Iron and Steel Federation Annual Report 1960. 40 pp. 23 pp. of appendices.**

Besides the President's speech, the Report contains chapters on Organization; Commercial Operations; Raw Materials; Prices, Costs and Finance; Development; Manpower; Information and Publicity; and International Affairs.

The chapter on Development has a section on Air Pollution, as follows:

" The Federation has continued to discuss with the Chief Alkali Inspector the best practicable means of dealing

with emissions from certain of the Industry's processes and codes of practice are being progressively established. Some examples of the progress being made may be quoted: efficient dust arrestment equipment must now be fitted to all new ore preparation plant and oxygen steel-making units; except during emergency, blast furnace gas bled to the atmosphere must be reasonably clean, and burned if practicable; and gases containing sulphur dioxide must be discharged from a chimney of an agreed height.

Companies intending to use oxygen intensively as standard steelmaking practice are now fitting cleaning units. High efficiency gas cleaning equipment is now in use with the " Ajax " steelmaking furnaces at the Appleby-Frodingham Steel Company and at the large electric arc furnaces at Samuel Fox and Company Ltd.; and Richard Thomas & Baldwins Ltd. have installed a high efficiency cleaning unit in conjunction with the LD steelmaking vessel at the Ebbw Vale works.

A special study is being made by the Federation of emissions from electric arc furnaces.

During the year, representatives of the Industry and the Alkali Inspectorate made a joint visit to Germany to obtain a first hand impression of the efficiency of cleaning plant applied to converter steelmaking units.

The Minister of Housing and Local Government made an order transferring from the Alkali Inspectorate to the Sheffield and District Clean Air Committee control of air pollution in the Sheffield area arising from a number of industrial processes, including ones in the iron and steel industry."

**Coal: Its Formation and Composition. By Wilfrid Francis. 2nd Edtn. Medium 8vo. VIII— 806 pp. 244 illus. Edward Arnold Ltd. London. 7 gns. net.**

This new edition reviews the recent literature, resolves questions raised by readers, and covers aspects of the subject not fully considered in the first edition. There are two new contributions by Dr. F. A. P. Maggs and Dr. P. H. Given, prominent research workers on the physical side of coal. The sections on terminology, classification and petrology review the post-war activities of the International Committees, and include the new terminology of petrology of the E.C.E. Classification and a comparison of the latter with the N.C.B. Code-number classification. Changes have been made, designed to assist the younger students of coal in understanding subjects of a specialized character.

**Boiler House Practice. By J. N. Williams. Revised 3rd Ed. 1960. 648 pp. 238 figs. George Allen & Unwin, London. 70s. net.**

A new edition of this text-book, which is of the greatest value to all who have dealings with boilers, and especially Smoke Inspectors and would-be Smoke Inspectors. The chapter on chimney emissions has been revised to take account of the Clean Air Act.

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**Mr. F. L. Waring**

Mr. F. L. Waring, Managing Director of the " Coalite " Group of Companies, has been elected Chairman of The Association of Chemical and Allied Employers. A past Chairman of the Yorkshire Section of the Institute of Fuel and the Immediate Past President of the Association of Tar Distillers, Mr. Waring was also recently elected Vice-Chairman of the Chemical and Allied Industries Joint Industrial Council.

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Solihull Council at a meeting on March 31st decided to defer for a year consideration of the introduction of two more smoke control areas in the town centre after members had criticized the shortage of smokeless fuels. There was a lengthy debate, in the course of which Councillor George Hill said that as the Clean Air Act was being operated at present it was a complete and utter farce.

# *Meeting at Morpeth*

## Importance of New Washery

A well-attended annual meeting of the North-East Division was held at Morpeth on April 21st. In the morning, by invitation of the National Coal Board, members were taken to the Ashington Colliery, where a number visited the workshops and others inspected the new stone washing plant that is described below. Returning to Morpeth, members were entertained to lunch by the N.C.B. and then followed a brief business meeting. After this Mr. J. S. Williams, Deputy Director of Marketing of the Coal Board, read the paper that is reproduced elsewhere in this issue.

At the A.G.M. Alderman Young of Gateshead was re-elected Chairman, Mr. Peter Isaac, Deputy Chairman, and Mr. G. W. Tate, Hon. Secretary. Illness prevented the attendance of Mr. Tate and a message of greetings and wishes for a speedy recovery were sent to him. Mr. Mair, of Newcastle-upon-Tyne kindly undertook to act for Mr. Tate for the time being.

### The Washery

This is of considerable interest from the clean air viewpoint, being a washery not for the removal of stone from coal, but of coal from stones. Ashington Colliery is a large unit with two coal winding shafts and two surface drifts in production, together producing about 5,500 tons run-of-mine coal per day.

Stone from the mining developments, *i.e.* rippings and drivages near the seam had been deposited in large quantities upon the adjacent tip. Because of the coal content of the



*North-East Division Members at the Ashington Colliery coal-from-stone Washery*

stones the tips were continually on fire and had to be treated by water to reduce the nuisance to the adjoining township of Ashington.

The Scientific and Coal Preparation departments in concert with mining engineers recommended the selection of the stones in pit tubs at the heapstead and the diversion of these to a stones washery plant for the extraction of the coal, which could then be suitably prepared for the market. Tests were made on realistically chosen stone tubs with a possible coal content and the results revealed that the proposition was most attractive.

Technical design of the plant was carried out in 1957 and the plant constructed under contract by the Blantyre Engineering Company. Work began on site in May 1957 and the plant was completed for a test trial in December 1958, later being taken over by the Coal Board.

**Operation**

Tubs of selected pit stones are passed through a rotary tippler and the contents delivered to a screen for primary screening at +6 in. The product then passes over a 42 in. wide inspection band for the removal of any timber or tramp iron which may be present. The +6 in. then passes to a crusher to be crushed to −6 in., which joins the −6 in. from the screen and the whole then passes to a Blantyre fully automatic Baum washbox at 50 tons per hour.



*A group of delegates at Ashington listening to an explanation of the working of the Washery*

The recovered coal and middlings pass over dewatering screens to a conveyor and thence into a 12 tons capacity hopper which reloads it into tubs. These tubs are delivered to a tippler for loading the product into railway wagons which are then transported to the Foreign Coal Wagon Hoppers at Ashington Colliery, unloaded, and the contents conveyed through the main washery for treatment. The plant operates over two shifts daily.

During the year 1960, 122,714 tons of stone were treated. These produced about 22,000 tons of saleable coal.

This means that, in addition to the operation minimizing, or completely removing, the danger of a burning tip, there is a financial profit.

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# MORE DIVISIONAL ACTIVITIES

The *South Wales and Monmouthshire* Division was reformed at a meeting in Cardiff on April 6th, when a new Council and Officer were elected. The meeting, which was attended by about fifty representatives of Local Authorities, was addressed by Mr. Arnold Marsh, Director of the Society.

Ald. Dr. C. A. Bence was elected chairman of the Division, and other officers elected were: Deputy Chairman, Mrs. Mainwaring; Secretary-Treasurer, Mr. J. A. Church; Council, Mr. A. M. Coleman (Bedwellty), Mr. R. Fook (Newport), Mr. A. Morgan (Mountain Ash), Mr. H. V. James (Gelligaer), Mr. G. A. Morgan (Port Talbot), Mr. I. Lewis (Pontardawe), Ald. W. H. Palmer (Monmouthshire C.C.), Mr. I. Thomas (Merthyr), Mr. W. J. Griffiths (Newport), Mr. S. T. Williams (Bedwellty), Mr. H. C. Bird (Monmouthshire C.C.), Mr. E. Jones (Ystradgynlais), Mr. D. Tudor (Merthyr), Mr. R. Matthews (Rhondda), Mr. T. Davies (Steel Co. of Wales),

Mr. D. I. Rowlands (Wales Gas Board) and Mr. A. W. Davies (National Coal Board). The Council was given power to co-opt further representatives.

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The *West Midlands* Division held their Annual General Meeting on April 20th at Park Foundry, Belper, at the invitation of Radiation Parkray Ltd. After the meeting, the delegates were entertained to lunch by the company and were then shown round the works which have recently been much extended and modernized. Included in the tour was the works of the Research and Development Division which has in recent years produced many novel features in traditional domestic solid fuel appliances.

* * *

Members of the *East Midlands* Division of the Society met in Kirkby-in-Ashfield on March 9th, 1961. They assembled at Kirkby Colliery and formed two parties. One visited the underground workings and the other the surface installations. The members were welcomed by the Colliery Manager, Mr. Cumberland. Lunch was provided at the invitation of the National Coal Board who were thanked by the Deputy Chairman, Mr. G. Drabble.

A meeting was held in the Festival Hall and a Civic Welcome was extended to the delegates by the Chairman of the Urban District Council (Councillor L. Scothern J.P.). An address was given by Mr. J. Menheneott, Senior Regional Sales Officer, North Midland Sales Region, National Coal Board, entitled: " The Coal Industry's Contribution to Clean Air ".

Mr. Menheneott stated that the Board was making a real contribution to clean air in many ways. At the collieries a great deal of progress had been achieved and thirty-six out of eighty-eight collieries in the East Midlands were now electrified. Two hundred mechanical stokers had been installed in boiler plants. The Board was working closely with the Public Health Inspectors.

In the domestic market a large tonnage of smokeless fuels was being provided by the Board and two new anthracite pits were coming into production. New smokeless fuels were being devised under the direction of Dr. Bronowski and pilot plants had been erected and would be operating later.

Films entitled: " Smokeless Fuels from Coal " and " Window to the Sky " were shown. An excellent discussion followed and many questions were asked.

A vote of thanks was carried to the speaker and to all who had contributed to the success of the meeting. Particular mention was made of the National Coal Board and their officers, the Chairman and members of the Urban District Council, their Clerk and the Public Health Inspector.

Tea was provided at the invitation of the Chairman and members of the Urban District Council.

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## CHESTERFIELD EXHIBITION

A successful exhibition, sponsored by the North-East Derbyshire Clean Air Joint Consultative Committee was held in Chesterfield in March. It was staged in conjunction with the Solid Smokeless Fuels Federation, the East Midlands Electricity and Gas Boards, and the Coal Utilization Council. The National Society for Clean Air had a stand.

The Exhibition was opened by the Director of the Society, Mr. Arnold Marsh, with Councillor Mrs. D. M. Ashley, Chairman of the Clowne R.D.C. presiding. In the course of his address Mr. Marsh said that recent investigations into the connection between air pollution and lung cancer had now reached the stage where if the amount of smoke in the atmosphere of a town or city were known, it could almost be estimated how many people would die of lung cancer in the next ten years.

# ACID SMUTS FROM OIL-FIRED PLANTS

*L. E. Reed, M.Sc.(Eng.), A.M.I.Mech.E.*

During the last few years there have been several references made in the technical press to the emission of acid smuts from oil-fired boilers. The purpose of this note is to give a summary of the position as it appears at present.

All plants burning residual fuel oil emit finely-divided solid carbonaceous particles, normally up to 70 microns[1] in size, which fall in the general neighbourhood of the chimney, so contributing to the dust and grime in the surrounding area. When the burners are correctly operated, the amount of this material in the stack gases should not exceed about 0·1 per cent. by weight of the oil burnt, but when the burners are dirty or badly-adjusted, this may rise to the order of 0·5 per cent. This latter figure is equal to the most favourable estimate[2] of the average emission of solids from all industrial plant burning coal.

At a surface temperature of about 290°F., acid condensation begins to form in the chimney, although heavy condensation does not occur until the surface temperature falls below 250°F. If the temperature of any part of the chimney or flue system falls below the acid dew-point, sulphuric acid condenses on the walls and traps a proportion of the carbonaceous dust, which builds up as a loose, highly-acidic, sooty scale, portions of which, up to nearly an inch in size, become detached and issue from the chimney as acid smuts. In comparison with the total weight of other pollutants, the total weight of acid smuts emitted is minute, but it causes such an intense local nuisance that a great deal of importance has had to be attached to its suppression. Warren Spring Laboratory recently asked all Local Authorities to state how many chimneys in their districts were emitting smuts, and the number of chimneys reported by the 1,300 Local Authorities who replied amounted only to the very modest total of 200. This is a conservative estimate, as in districts where the density of oil-fired plant is high, as in Central London, it is not possible to determine how many chimneys are creating a nuisance. It is considered likely, however, that many more chimneys emit smuts on occasion without becoming a persistent nuisance.

Members of the Atmospheric Pollution division of Warren Spring Laboratory have inspected a small proportion of the offending chimneys and it was felt that in many cases a cure could be effected by the application of the commonsense principles of good boiler-house management, which would prevent conditions developing that lead to the production of smuts. In some instances, however, the problem is not nearly so simple, as in the case of the large efficient water-tube boilers of the Central Electricity Generating Board which stand in a class apart from other smut-emitting plant, in that their high efficiency demands the cooling of the flue gas to a temperature approaching the acid dew point; this makes it difficult to keep the system hot enough to prevent smut formation. The special problems of these boilers are receiving most urgent attention from the Board's engineers, but it is unlikely that the solutions or palliatives they may devise will be applicable to smaller plant.

For smaller, well-designed plant

[1] 1 micron—approx. 1/25,000 of an inch.

[2] Brown, R. L., Hawlsley, P. G. W., and Horspool, J. M. Facts About Air Pollution From Homes and Factories. Inst. Public Hlth. Engrs., May, 1959.

running under a reasonable load there should be no question of smut emission. If the chimney is a metal one, it will need lagging, as described by Blum, Lees and Rendle (*J. Inst. Fuel*, April 1959) to keep the temperature above the acid dew-point.

Points of bad design from the point of view of the production of smuts include unnecessarily-wide chimneys, long lengths of flue connecting the boiler and the chimney, and off-load boilers with badly fitting dampers. Long horizontal flues act as settling chambers for the particulate carbon and any sudden increase in the gas velocity, such as occurs when lighting up, will blow the accumulated dust out of the chimney. Provision should be made for access to any ducts and flues so that they can be cleaned out regularly. In addition any metal ducting between the boiler and the chimney must be adequately lagged or smuts will form on the inner surface.

Plants with a variable seasonal load may experience difficulty in keeping a large chimney hot during periods of low load. If the plant consists of a number of boilers discharging into one chimney, a possible solution is to divide the chimney into a number of compartments with suitable dampers and so on, so that the cross-section of chimney actually in use at any time fits the load. Such a solution, however, may be expensive. If the boiler is extremely underloaded then division of the chimney is not likely to be effective, as the heat carried into it will not be sufficient to maintain the temperature.

A new process for reducing smuts which has been recently introduced is the injection of a finely-divided alkaline powder into the flue gas at the boiler outlet. The powder, it is claimed, neutralizes the acidity of the flue gases and causes aggregation of the particles, which are then removed in a form of cyclone cleaner. Although the process has not been functioning long enough for a full assessment to be made there is some evidence that this method does prevent the emission of smuts.

If preventive measures are inapplicable or unsuccessful, then methods must be considered of removing smuts from the stack gases once they have formed. It is no use removing smuts at the bottom of the chimney, as more can form higher up; any cleaning plant must therefore be installed at the top of the chimney. One such manufactured device is similar in principle to that used to remove grit from the flue gas of coal-fired boilers. It consists of a series of vanes which impart a swirl to the gas, with the centrifugal force acting on the smuts to throw them into a collecting section from which they are removed by a flow of water. The cleaned gas is then emitted from the chimney.

Considering the general position of pollution by acid smuts, then, it would seem that in the majority of cases offending chimneys could be cured by relatively simple means. Vigorous action should produce a great improvement in a relatively short time. It would also appear that a little more care in the planning stage would ensure that new plant would not emit smuts.

Operators of plant which emit smuts are frequently pressed by Local Authorities to take remedial action, but satisfactory technical advice may not be readily available locally. To ensure that expert advice is available to all, a D.S.I.R. panel has been formed consisting of representatives from the oil and burner industries, the Central Electricity Generating Board[3] and Warren Spring Laboratory. All problems concerning smut emission should, in the first instance, be referred to the technical department of the oil supplier.

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[3] By the time this article is published, N.I.F.E.S. will probably also be represented on the panel.

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**10,000 Advised to leave Los Angeles**

More than 10,000 people have been advised by doctors to leave Los Angeles because of the effects of smog on their health, says the County Air Pollution Committee. About 2,500 took the advice last year.

# *Electricity in Scotland*

## Board's Report for 1960

**South of Scotland Electricity Board: Annual Report and Accounts for 1960. H.M.S.O., 4s. 6d. net.**

The activities of the Board continue to expand: an increase in units sold of 11·2 per cent. of the maximum demand of 16·3 per cent., in the number of consumers of 16,236 and a notable increase in the number of off-peak consumers. The average price per unit sold was 1·498d. compared with 1·5d. for 1959.

The generating plant comprises eleven thermal stations with an output capacity of 1·641 MW., five Galloway hydro-electric stations of 107 MW. and two Lanarkshire hydro-electric stations of 15 MW. This is supplemented by some 110 MW. from the Chapelcross factory of the Atomic Energy Authority, and interchange supplies with the North of Scotland Hydro-electric Board and the Central Electricity Generating Board.

During the year the third 120 MW. set was started at Kincardine making the total output capacity 336 MW. The plant programme envisages the commissioning of two 200 MW. sets at Kincardine, one 60 MW. set at Braehead, two 180 MW. sets at Hunterston Atomic station, while the pumped storage station at Loch Awe of the North of Scotland Board will make available a further 400 MW.

The overall thermal efficiency of



*A block of 20 storey houses with electrical floor heating being erected in Glasgow. Photograph from the Report*

generation at the thermal stations increased from 26·14 in 1959 to 27·27 per cent., to which thermal efficiencies respectively at Kincardine, Portobello, Dalmarnock and Braehead of 33·39, 30·57, 29·42 and 28·17 per cent. contributed. 68·4 per cent. of units sent out were supplied by these four stations.

Generating stations used 2,846,100 tons of coal, 292,612 tons of washery slurry, and 39,234 tons of coke breeze all from Scottish sources. The average price of fuel excluding slurry was 93s. 10d. a ton.

A contract has been made for the marketing of fly ash from pulverized fuel boilers. Atmospheric pollution surveys were carried out and tests made on grit arresting plants.

565 million units were imported from the North of Scotland Board and 96 million units were supplied to them. The net import from the Central Electricity Generating Board was 207 million units. Imports from Chapelcross totalled 995 million units, 12·3 per cent. of the system requirements.

The 275,000 volt and the 132,000 volt transmission systems have been developed during the year. Contracts were placed for the high crossings of the Forth and Clyde.

Domestic, farm and commercial sales rose by 14·7 per cent., industrial sales by 8·3 per cent. 321 farms were connected and 94 per cent. of farms in the district are now supplied.

A notable development in off-peak supply has taken place during the year, the load connected at the end of the year amounting to 289,191 kilowatts allocated between space heating 200,553 kilowatts, furnaces 31,800 kilowatts, water heating 23,886 kilowatts, process heating 4,380 kilowatts, and miscellaneous 28,572 kilowatts. Some 15,000 local authority houses with floor-warming and water heating are connected or under construction, including blocks of twenty storey flats in Glasgow and Edinburgh. 287 schools built or under construction use or will use off-peak electricity for space and water heating.

The Clean Air Act is leading to an increased use of electricity for space and water heating. In the case of domestic premises, many consumers would like to take advantage of low off-peak tariffs, but are precluded from doing so by the inability to obtain block storage heaters. Off-peak development improved the load factor during 1960 from 43·8 to 45·6 per cent.

Income from sales of electricity and other sources amounted to £49·3 millions compared with £45 million in 1959, resulting in a surplus of £415,000 which raised the revenue balance to £1,052,000

Capital expenditure during the year totalled £25·9 million of which £10·15 million was in respect of Hunterston and £3·89 million in respect of Kincardine.

The staff employed at the end of the year numbered 13,444 compared with 12,758 a year previous.—*A.J.C.*

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## CHALK FARM POLLUTION LEVELS

The complaints about smoke and fumes from the Camden motive power depot of British Railways, which have been a main concern of the Chalk Farm Residents' Association for a number of years, have now been investigated, by measurements of the pollution, by the London County Council. A report has now been issued of a five-month survey carried out by the L.C.C. from November 1958 to March 1959, based on a house in Gloucester Avenue, N.W.1, which stands only 50 yards from the locomotive sheds.

The survey showed that concentrations of smoke and sulphur dioxide were 102 per cent. and 43 per cent. higher than the general London levels. With the wind in certain directions these figures rose to at least 200 and 100 per cent. respectively.

The report adds that the situation is expected to improve with the replacement of steam locomotives with diesels, but the Association has asked that further observations should be made to determine to what extent improvement has taken place.

# TECHNICAL NEWS

## REDESIGNED INDUSTRIAL ELECTRICAL AIR FILTER

The Trion Electronic Air Filter, marketed for industrial applications by W. C. Holmes & Co. Ltd. since 1956, has been redesigned to meet the arduous operating conditions encountered in industry, and it will in future be known as the Industrion Electrical Air Filter.

The new filter is of much sturdier construction than its predecessor, the collecting cell is fabricated from a heavier gauge aluminium and the supporting framework and ionising section support bar have been strengthened. Another advantage is that the insulators are now positioned out of the main air stream; this facilitates cleaning and ensures greater reliability.

The associated electrical equipment has also been improved and there are now two standard sizes of power units which, in various combinations, meet the power requirements of individual installations. The electrical equipment is also more robust than before and now includes inherent current limitation which protects the equipment in the event of a short circuit. The larger unit is fitted with a constant voltage transformer to provide a stable and effective performance under varying atmospheric and dust loading conditions.

A further development is the introduction of a special heavy duty filter which is intended for use on applications where the dust burden is higher than that handled by the standard filter. With this heavy duty filter, pre-collectors of the multi-cell cyclone type are normally fitted to arrest any large particles which may be present in the extract system.

Each heavy duty filter installation will be individually designed after careful consideration of the data available. Where full information is not available, pilot plant tests will be carried out on site to determine the actual operating conditions and to obtain the design data required. A filter arrangement comprises an ionising section followed by one or more collecting plate sections in series. The combination of these sections is determined by the collection efficiency required and dust holding capacity necessary to give reasonable periods between cleaning.

As opposed to the standard filter which is cleaned by washing, heavy duty filters are normally arranged for dry removal of the dust, the complete filter section being vibrated to dislodge the collected dust which falls into storage hoppers below the filter. The cleaning operation occupies only a few seconds and the filter can be immediately returned to line. One of the advantages of this system of cleaning is that the filter can be frequently cleaned thus allowing a high dust burden to be handled.

The Industrion range is completed by the Industrion Oil Mist Precipitator which has been specifically designed for the elimination of oil mist and smoke emanating from high speed cutting, grinding and machining operations.

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## DIESEL DEODORANT

For some years now the Redex Company has marketed a diesel fuel additive, the purpose of which is to keep the injectors, piston and piston rings carbon free. This helps to keep the engine clean and, to quote a recent speech by Mr. J. R. Morrice, Director and General Manager of the company, " materially reduces the main cause of heavy smoke emission, other than from mechanical causes."

Mr. Morrice was speaking at a meeting in London, the main purpose of which was to publicize a newer form of the additive, known as Redex D.D., or Deodorant. This, it was said, will deodorize diesel fuel in bulk; take away the unpleasant smell of diesel fuel in the driver's cab; give

a pleasant smell to the diesel exhaust; and materially reduce, or eliminate, the lachrymal effects and nasal irritation which are so prevalent with diesel exhausts.

Independent laboratory tests have indicated that by using this material the carbon dioxide and oxygen content of the exhaust gases remain about the same, the carbon monoxide content is lowered (average 0·023 to 0·018 per cent. on six tests), group aldehydes (R-CHO) are reduced from an average reading of 5 to 3, and the soot and carbon number is reduced from an average of 1·9 to 1·25.

Possibly more instructive than statistics are the letters and photographs from well-known firms and organizations operating fleets of diesel vehicles who are using Redex DD. As an example, one of the best-known firms of battery manufacturers had written: " We have, as you know, been using Redex consistently for some ten years in our fleet of vehicles of various types and sizes and have found its use justified, particularly in reducing carbon deposits and bore wear and as an aid in starting from cold. We have used your new diesel deodorant since its introduction and are satisfied that it does have the additional worthwhile advantages of reducing exhaust smoke and eliminating the unpleasant smell of fumes."

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## A FLUE DUST MONITOR

A monitor has been developed to determine the emission of dust particles from industrial chimneys. It comprises a sampling and measuring unit, a control unit, and a recorder.

The sampling unit consists of a small horizontal duct, facing into the gas stream, and leading into a vertical duct, which is sealed by glass plates at top and bottom. Coarse particles of dust are carried into the vertical duct and collect on the bottom plate; flue gases and fine dust are deflected round the duct. The measuring unit is an optical system of lenses and prisms, which directs light from a lamp bulb outside the duct through the glass collector plate and back again. The beam is focused on to a photo-transistor through an optical wedge, and the current generated is fed to one coil of a differential relay in the control unit; another photo-transistor, lit directly by the lamp beam, determines the current in the other coil of the relay. When dust has settled on the collector plate for a given time, the wedge is driven round by a reversible electric motor until the photocell current is adjusted sufficiently to operate the relay. Wedge movement is directly proportional to the amount of dust which has settled. While the wedge is being rotated, impulses are transmitted to the recorder, and actuate a pen to record on a 24-hour chart the concentration of dust. A counter combines all impulses, so that totals can easily be obtained.

The unit is manufactured by Evans Electroselenium Ltd., St. Andrew's Works, Halstead, Essex.

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## REDUCING TOXIC GASES FROM DIESELS

The Dunedin Engineering Co. Ltd., well-known for their diesel-testing instruments, recently held a meeting to announce an entirely new method of controlling the toxic gas emissions from diesel engine exhausts. It was stated that the oxides of nitrogen, aldehydes and carbon monoxide could be reduced " to very small quantities which comply well within the limits laid down by regulations controlling the use of diesel engines in underground and enclosed working places." The tests that were reported had been carried out on diesel locomotives working underground.

The principle of the control unit that is required is quite simple, being merely to reduce the existing excess air supply. Normally only about 60 per cent. of the air aspirated is utilized and it was stated that the formation of nitric oxide, etc., is inhibited if less free oxygen is avail-

able, and similarly at lower temperatures with the formation of aldehydes.

The degree of reduction of air must be carefully controlled after the testing of fuel injection performance and compression pressures. To maintain continuity of performance over long period in atmospheres with a high dust content, a special expanding air pre-cleaner, which is expendable, has been devised.

Further research on this interesting development is in progress.

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**Swedish Precipitator for London Steam Power Plant**

Paraklon, the system developed by Svensk Flaktfabriken for high efficiency mechanical precipitation, is to be installed at the Deptford power station in London. the Swedish company reports.

Fourteen Paraklon units, each capable of handling 128,000 cu.m. of gas per hour, will be used for purifying the gases from the coal-fired boilers at the power station. The order, obtained by Svenska Flaktfabriken's British licensees, E. Green & Son, Wakefield, is reported to be worth £138,000.

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**Chamber of Commerce President Criticises Tax**

Referring to the new tax on heavy oil, the president of the Leeds Chamber of Commerce, Mr. R. H. Braime, said this would be a burden on those industries which had converted from coal to oil-burning to implement the Clean Air Act. " Now they are going to be penalized for their co-operation," he said.



*Cleaner Air in the Midlands—The dust from cupolas melting iron goes straight into the atmosphere unless arrested. Nine arrestors have been fitted to existing cupolas during the past twelve months by the Incandescent Heat Company Ltd. in association with the Whiting Corporation of America. The combined melting rate of these cupolas (at Kings Norton, Smethwick and Longbridge) would be about 88 tons per hour. On this basis the new arrestors would collect about 1·25 tons of dust per hour*

## *Clean Air Progress in Lancashire*

**Mr. E. Taylor** asked the Minister of Housing and Local Government and Minister for Welsh Affairs what percentage of industrial towns in Lancashire have made smoke control orders; and whether he is satisfied with the progress so far made in implementing the provisions of the Clean Air Act.

**The Parliamentary Secretary to the Ministry of Housing and Local Government (Sir Keith Joseph):** There is no accepted definition of any industrial town. In Lancashire 36 per cent. of all urban authorities and 49 per cent. of black area urban authorities have made orders. Generally speaking, quite a good start has been made, but my right hon. Friend would like to see all black area authorities making full and vigorous use of their powers.

**Mr. Taylor:** In view of the tremendous advantages gained from the drive against atmospheric pollution, will the hon. Gentleman please tell me if he contemplates taking action against backward authorities which are slow to make this progress?

**Sir K. Joseph:** Only persuasion and publicity are in the mind of my right hon. Friend. It is fair to realize that in this region generally 80 per cent. of the black area authorities have submitted smoke control programmes and all but three of those have a target date before 1981.

**Mr. Maurice Macmillan:** Is my hon. Friend aware that for some time there has been great concern in the West Riding of Yorkshire and that an interesting pamphlet on this subject was published by the hon. Member for Halifax in the 1880's.

**Mr. Ellis Smith:** Is the Parliamentary Secretary aware that the Trafford Park area and the Lancashire area are the worst areas in the country? Will he ask his regional officers to give special attention to the area referred to by his hon. Friend?

**Sir K. Joseph:** My right hon. Friend welcomes all this evidence of interest and would hope that hon. Members will bring these representations to the notice of their local authorities as well. (*March 28th, 1961*).

## ADEQUATE FUEL IN SCOTLAND

The Society's Chairman, Mr. John Innes, M.B.E., together with Baillie William Reid, represented Paisley at a conference attended by 19 West of Scotland local authorities last March. The conference, which was to launch a public campaign to win support for smoke control, was assured that supplies of domestic smokeless fuel were adequate to meet all foreseeable demand in Scotland up to 1965.

Plans were being made to create vast new sources of solid smokeless fuels to meet the needs of the growing smoke control areas, Mr. John George, Parliamentary Secretary to the Ministry of Power, told the meeting. The Gas Board, on their side, were concentrating on a new British standardized coke, substantially better than ordinary gas coke.

Mr. Thomas Galbraith, Joint Parliamentary Under-Secretary of State said that, by 1963, almost all industrial furnaces would be equipped to eliminate smoke, but the pollution from house-chimneys was particularly serious because of the low-level discharge in concentrated form during the winter months. He added: "It has been calculated that if the air were clean, savings in laundry bills, painting and decorating, building maintenance and repairs, would amount to £25,000,000 all over Scotland."

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### Councillors see Steelworks Pollution Methods

About twenty members of Scunthorpe Borough Council visited the works of Appleby-Frodingham recently, to view the methods being employed by the company to deal with the red fume resulting from the oxygen steel-making furnaces. Mr. Albert Jackson, technical adviser on steelmaking to the United Steel Companies, told them how the company had originally had to go abroad to obtain a cleaner which would remove the fume from the gases emitted from the first furnace installed. Subsequently, however, a British cleaner had been developed, though not without considerable teething troubles. The latest version of this cleaner, fitted to the third and fourth furnace installed, has three stages, with the object of making absolutely certain that no fume whatever could leave the furnace chimney.

# AIR POLLUTION ABSTRACTS

**509. Prevention of Atmospheric Pollution During the Burning-Out of Producer-Gas Flues.** Bulcraig, W. R., et al. (J. Inst. Fuel, **34,** (243), April, 1961, 163-166). It has been shown that atmospheric pollution which occurs during the burning-out of the tarry deposits left in the producer-gas flues can be prevented by the use of a combustion box, provided the correct conditions can be established. Over 99 per cent. of the combustible matter in the gases before the combustion box can be consumed and the smoke emitted from the chimney stack will be less than Ringelmann No. 2.

**510. Measurement of Dust Content in Industrial Gases. VI: Quantative measurement of dust.** (In German.) Guthmann, K. (Arch. Tech. Messen, November, 1960, (298), 225-228: Instrum. Abs., March, 1961, **16,** 189.) Methods of measurement are sub-divided into six groups (gravimetric, number of particles, optical, discolouration, filter, and valuation) and are compared in a table. The following instruments are described in detail: Gothe Cyclosonde, CEGB Instrument, Gast Balance, Photo-Electric Smoke Density Meter, and the Eckardt Konitest. Twenty-five references. (DSIR.)

**511. Smut Formation in Flue Gases.** (In German.) Hesselbrock, H. (Mitt. VGB, December, 1960, (69), 411-413: Mon. Tech. Bull. ICL, February, 1961, **15,** 58). Based on French investigations an explanation of the formation of agglomerations of dust particles by thermal and pressure diffusion, chemical reaction and electrical charges and the uptake of gases ($CO_2$, $SO_2$, $SO_3$), and the deposition of smutty particles near chimneys is given. (DSIR.)

**512. Light-Scatter Instrumentation for Measurement of Atmospheric Particulates.** Nader, J. S., et al. (Amer. Ind. Hyg. Assoc. J., February, 1961, **22,** 42-48). The determination of mass and count measurements of particulates in air by use of light-scattering instruments is discussed. Operation and performance of the monitron and a miniaturized, portable instrument are described, and data on comparisons with other instruments are given. Eleven references. (DSIR.)

**513. The Electrolytic Determination of Carbon Monoxide.** Ovendon, P. J. (J. Electroanalit. M., January-February, 1961, **2,** 80-87). The electrometric determination of gaseous carbon monoxide is discussed. A method is described for the continuous estimation of carbon monoxide in air, using a vibrating Pd micro-electrode which is intermittently polarized anodically whilst the air sample is passing through the cell. A limiting diffusion current is observed which bears approximately linear relationship to the partial pressure of carbon monoxide in mixtures of carbon monoxide and oxygen. Thirteen references. (DSIR.)

**514. Selection of Air Pollution Control Equipment.** Teller, A. J. (Industr. Wat. and Wastes, January-February, 1961, **6,** 21-26). In order to develop a more fundamental approach to the design of air pollution control equipment, an analysis is made here of the effects of system variables on equipment. Included are packed towers, spray towers, tray towers, venturies, semiclones, and jet scrubbers. Examples which demonstrate that the applicability of each type of unit is dependent on the specific problem involved are developed in this paper. (DSIR.)

**515. The Prediction of Atmospheric Diffusion by Using an Eddy Diffusivity Based on the Vertical Transfer of Heat.** (J. Met., February, 1961, **18,** 43-49). Vertical profiles of temperature up to 16m and heat-flux data have been used to compute the eddy diffusivity for the vertical turbulent transfer of heat. (DSIR.)

**516. Inter-Relation Between Sulphur Oxides and Soot in the Combustion Appliances.** Watson, D. (Univ. of Sheffield Fuel. Soc. J., 1960, **11,** 48-57). The literature is reviewed and results given of experimental work. It was found that $SO_2$ reacted with a cold distillation smoke and that this reaction did not cause the smoke particles to become acidic. Coal smoke was found to absorb $SO_2$ appreciably at room temperatures but absorption was negligible at flue gas temperatures. It was concluded that reactions between $SO_2$ and smoke were not responsible for the emission of acid smuts from combustion appliances. (DSIR.)

**517. Detection of Free Charges from Motor Car Exhaust Gases.** Westermark, T. (Nature, London, 18 March, 1961, **189,**

910). A description is given of the charge collection chamber together with a brief account of the results obtained. (DSIR.)

**518. The Reduction of Air Pollution Arising from Trade Processes, With Particular Reference to Integrated Steel Works.** Wilkinson, G. H. (Essay to the Royal Society for the Promotion of Health, 1960, John S. Owen prize competition, 107 pages). The essay deals with coke ovens, sintering, blast furnace, pre-refining, the pneumatic processes, open hearth furnace and electric furnace, with the general conclusion. One hundred and thirty-four references. (DSIR.)

**519. Tentative Method of Test for Particulate Matter in the Atmosphere: Optical Density of Filtered Deposit.** American Society for Testing Materials. (Philadelphia: the Society, 1960, "1960 Supplement to book of A.S.T.M. Standards including Tentatives, Part 10," ASTMD 1704-59 T, 253-260). This method covers procedures for measuring the extent of soiling or darkening of clean filter paper or other white fibrous media by filteration of particulate matter in the atmosphere. Measurement is based on the light transmission or reflectance properties of the deposited solid or liquid particles that originally were dispersed in a gaseous medium. (DSIR.)

**520. Tentative Method for Collection and Analysis of Dust Fall.** American Society for Testing Materials (Philadelphia: The Society, 1960, "1960 Supplement to book of ASTM Standards including tentatives, Part 10," ASTMD 1739-60T, 261-264). Open-top collectors of a specified size and shape are located carefully outdoors to provide samples that are representative of the area being studied. Collected material is taken to the laboratory for weighing and analysis to determine total weight of dust fall, total water and benzine solubles, and total of combustible and non-combustible matter. (DSIR.)

**521. Scale-Up of Dust-Removal Plant.** Bainbridge, C. A. (Chem. Proc. Eng., March, 1961, **42,** 115-116: S.-C., 1961, 18, (6), 378). How scale-up of plant is carried out in practice is demonstrated in a case history of a problem concerning the removal of carbon black from fully saturated gas. (DSIR.)

**522. Simplified Techniques in Air Pollution Measurement.** Hendrickson, E. R. (J. Sanit. Engng. Div., Proc. Amer. Soc. Civ. Engrs., September, 1958, **84,** (SA5), Pap. 1776; Engng. Progr. Univ. Fla., March, 1960, **14,** (3) Leaf. Ser., (118), 8 pages). Methods are discussed for sulphur dioxide, particularly in gaseous form, gaseous fluorides, hydrogen sulphide and ozone. Generally, results obtained correlate quite well with results obtained by other procedures. (DSIR.)

**523. Hydro Carbon Emissions from Automobiles.** Lepisto, P. R., et al. (San Marino, Calif.; Air Pollution Foundation, February, 1961, Report 32, 45 pages). This study was undertaken to examine all normal sources of hydro-carbon emissions from automobiles. Special emphasis was placed on crank case fumes, carburettor evaporation losses and fuel tank evaporation losses. Exhaust emissions were also measured in order to provide a basis for comparison. The results reported can be presented on a basis which may be indicative of the average total hydrocarbon emissions of passenger cars. (DSIR.)

**524. Domestic Heating with Liquid Fuel: Combustion-Protection Against Pollution and Corrosion.** (In Italian: English Summary). Mastrorazio, F. (Rev. Combust., December, 1960, **14,** 928-943). The principle practical procedures to be followed with oil fired domestic heating installations in order to achieve the highest economic efficiency, maximum life of boilers and flues, and minimum air pollution are outlined. These are: suitable design; use of oil of suitable viscosity; correct mode of operation, preferably automatic; means of ensuring hot circulation in the boiler; and thermal insolation of flues so as to avoid corrosive condensation of sulphur acid. Six references. (DSIR.)

**525. The Grass Roots approach to Air Pollution Control.** Borman, H. C. and Fitzmaurice, T. J. (Coal. Util., December, 1960, **14,** 50-51, 76-77; APCA, March 1961, **6,** 1). Air pollution control has been a key activity of coal industry groups for a long period of time. In 1960 NCA formally established an Air Pollution Control Division, and this was the beginning of the grass roots programme, designed to solve the air contamination problems of the source, the offending plant. The objective set for the division is the reduction of potential emissions to the atmosphere from utilization of bituminous coal. The division attempts to establish voluntary community air pollution control programmes, particularly in communities of 75,000 population or less. It helps in recommending and shaping research projects designed to eliminate

pollution through improved methods and equipment. (DSIR).

**526. Process of Development in Removing Sulphur Dioxide from Hot Flue Gases. Part 1: Bench-scale experimentation.** Bienstock, D., et al. (U.S. Bureau of Mines Report Invest., 1961, (5735), 29 pages). Results are reported of an extensive investigation, using metalic oxides as absorbents, adsorbents and oxidation catalysts at 130° and 330°C. (temperatures at which flue gas may be treated in Power Plant practice). The most active absorbents tested were the oxides of manganese, cobalt, copper and alkalized alumina. A more detailed study is reported on absorption and regeneration, using manganese oxides and alkalized alumina. (DSIR).

**527. The Production and Marketing of Cleanglow.** Cunnold, C. C. and Rose, B. G. (Gas. J., March 22nd, 1961, **305,** 435-445). Traces the development of the process for Cleanglow production and details of the coals employed. The process is described and special reference is made to the skurfing technique and temperature control system. Characteristics of Cleanglow are discussed and the increase in demand is noted.

**528. Intermittent Release of Smoke from Chimneys.** Turner, J. S. (J. Mech. Engng. Sci., 1960 (June), **2,** 97-100). Dimensional arguments and the results of recent laboratory experiments are used to show that a considerable increase in the height attained in a calm stable atmosphere could be expected if the effluent were forced out of chimneys at high velocity in discrete puffs rather than continuously. Numerical values are given for the final height, the size of the chimney and the optimum storage and release times under various conditions. An important application is likely to be noxious gases which could be removed to a safe height with very little mixing into the atmosphere at lower levels. (Authors Abstract).

**529. AEI Electrostatic Dust-Measuring Equipment.** Anon. (Engng. Boil. Hse. Rev., 1960 (October), **75,** 332). The equipment records the density of smoke discharged through a chimney. It automatically takes into account the product of particle number, velocity, and area by providing the flowing gas sample with the corona environment; each particle becomes electrically charged in proportion to its surface area. The charge formed on collecting the particles indicates the level of pollution. (BCURA).

**530. Absorbing Sulphur Dioxide on Dry Ion Exchange Resins.** Cole, R. and Shulman, H. L. (Industr. Engng. Chem., 1960 (October), **52,** 859-860). Ion exchange resins might be used to remove sulphur dioxides from the flue gases. A study has been made of the absorptive-capacity/temperature characteristics of dry Ion exchange resins in contact with air/sulphur dioxide mixtures. (BCURA).

**531. Air Pollution, the Respiratory Tract and Public Health.** Andelman, S. L. (Eye, Ear, Nose, Throat Monthly, December, 1960, **39,** 961-964; APCA, March, 1961, **6,** 6). Effects of aerial sewage on human health range from irritation of the nose, throat, and eyes to aggravation of respiratory tract disorders and cardiovascular ailments. Evidence has been accumulating to link polluted air to the increased incidents of chronic bronchitis, emphysema, bronchospasm, and lung cancer among urban dwellers. Sulphur dioxide has been identified as the principle culprit of the air pollutant family, with ozone being the second most important gaseous offender. The latter gas is a product of the photochemical oxidation of hydro-carbons derived from the partial combustion of gasolene and diesel fuel. Atmospheric concentrations above 0·2 ppm. irritate the air passages of the respiratory tract, cause pain in the chest, cough, dyspmea, and nausea. (DSIR).

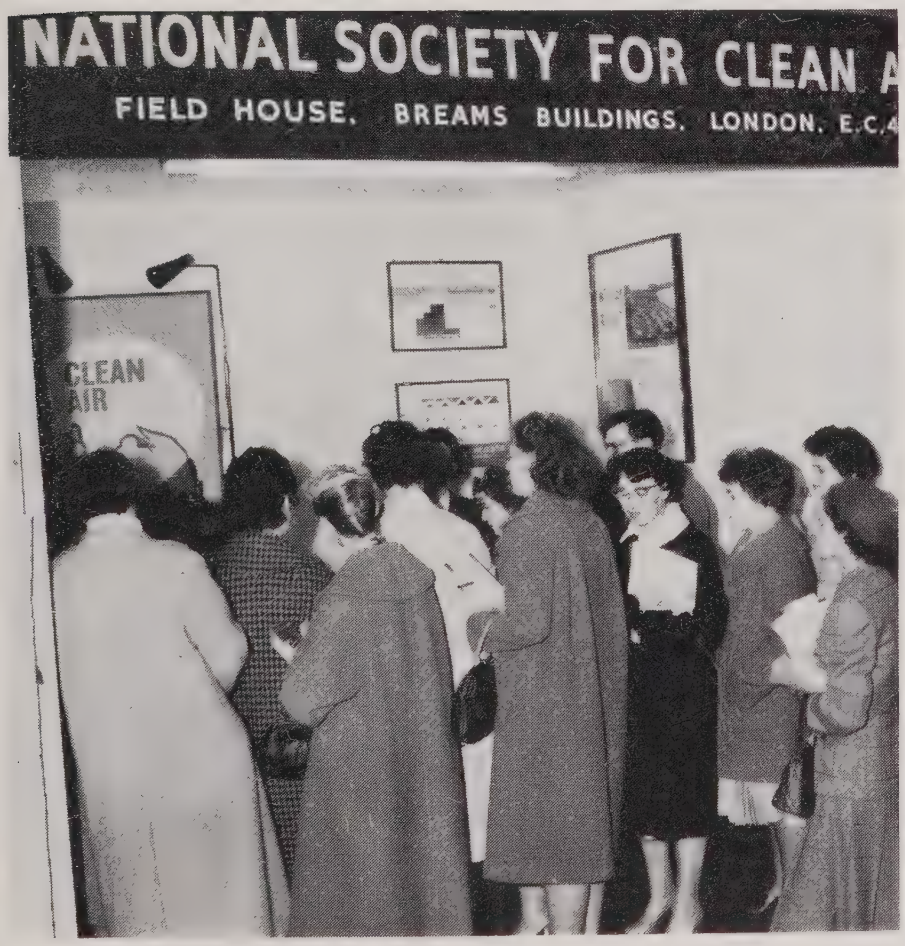
**532. Chimney Heights.** Eastwood, L. (Sanitarian, London, April, 1961, **69,** 324-327). The purpose of this article is to draw attention to the need for official standards of maximum ground level concentration of sulphur and deposition of dust in chimney calculations. It is suggested that, until such standards are available, sulphur provides the most solid foundation for the calculation of chimney heights. (DSIR).

**533. An Appraisal of Air Pollution in Minnesota.** Minnesota Department of Health (The Department, January, 1961). This appraisal of the air pollution situation in Minnesota arose from a growing concern about air pollution problems in the State. Increasing requests for information and assistance registered with the State Department of Health by local citizens and organizations indicated expanding interest throughout the State. The advice and counsel of the U.S. Public Health Service were obtained concerning methods of conducting a survey which would establish the nature

and extent of the air pollution problem in the State and indicate what activity is needed on the part of the State and Local Governments in meeting the problem. Data used in preparing this Report was obtained by interviews, direct observation, questionnaires, limited air sampling, and review of existing information. The appraisal was made from October 1959 to July 1960.

**534. The New Wilton High-Pressure Cyclone Boiler.** Holmes-Smith, E. et al. (Paper presented to the Institute of Fuel on Wednesday, March 22nd, 1961). The cyclone-fired boiler with a rating of 530,000 lb./h at 1,700 lb./in.$^2$ gauge and 1,065°F. at the super heater outlet is installed in the Power Station of a large chemical factory. The existing Power Plant is briefly described and the reasons leading up to the specification of the new unit are outlined. The performance of the boiler during the first year of operation is reviewed and the principle operating difficulties are discussed. Further operating experience beyond that of the first year will be necessary before the potentialities of the unit can be fully assessed, and the Paper is presented as a progress report to invite discussion of experience gained so far. A factor in the choice of a cyclone unit was the fact that ash retention in units of this kind is as high as 80 to 85 per cent. and the form of ash is less objectionable than that from pulverized-coal firing for disposal either as fill or as a usable by-product. This expectation has been borne out by the operation of this cyclone so far. Size analyses of the dust from the boiler show that the dust contains less coarse particles than that from the pulverized-coal-fired boilers. Provision is made for refiring of the precipitator grits in the boiler if the carbon in dust is high or if disposal of the fly-ash is inconvenient. Neglecting the cost of handling, refiring of the grits increases the loss of heat because of the greater quantity of molten slag and is economical only if the carbon in grit is more than 6 per cent. The average amount of carbon in grit is about 10 per cent.

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*A party of interested student nurses examining the Society's stand at the recent Royal Society of Health Congress Exhibition at Blackpool*

# CLEANER AIR*

*by*

*J. W. Batey*

**Superintendent Smoke Inspector, Sheffield**

It might be interesting and profitable to look into the past and consider the opinions held by our predecessors some hundred years ago. In the " golden age " of industrial prosperity was smoke considered to be a nuisance? Were the early Victorians in that new age a team insensitive to smoke? Were the principles of smokeless combustion apprehended?

In the Journal of the Royal Society of Arts of a hundred years ago there is a vivid description of a chain-grate stoker which saved a firm some £8,000 in a ten-year period. There is a delightful story of the introduction of secondary air over the furnace fire of a steamship, which brought the engine revolutions up from 19 to 21—" and no black smoke was ever seen from her funnel to pave the sky with carbon from port to port ".

A certain Neil Arnott estimated the extra cost of washing clothes, in London only, at two million and a half sterling; and a Mr. Tomlinson wanted a definition of smoke, which by the way we have not yet achieved. The great Count Rumford stated that five-sixths of the whole heat produced in an ordinary English fireplace went up the chimney with the smoke, to waste.

Fumbling attempts were made to take legal action against smoke nuisances. A prosecution was brought in Sheffield as early as 1811. In 1831 proceedings were taken against a firm chosen by ballot from among the half-dozen worst industrial offenders. Between 1855 and 1865 prosecutions under the new Smoke Byelaws were taking place at the rate of 45 per annum.

It is obvious then, from these brief extracts of a hundred years ago, that the knowledge was available—all it needed was application. Unfortunately the law, though by no means a dead letter, was limited in its scope. We have had to wait close on a century for Parliament to recognize that greater legal powers were necessary. Now that the law has been strengthened we find a startling difference in the application of this old knowledge.

* *Extracted from the Section by Mr. Batey in the Annual Report on the Health of the City of Sheffield, 1959.*

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**Unsuitable Fuel Defence**

Highams Ltd., Valley Mill, were summoned by the Corporation for producing dark and black smoke from the mill chimney. Dark smoke was emitted for 19 minutes in a 21 minute observation by Mr. William Gartside, the Rochdale Corporation smoke inspector.

This was agreed by the company who, however, claimed that the emission was due to the use of unsuitable fuel. No suitable fuel was available, and all practicable steps had been taken to minimise the smoke emission.

The magistrates accepted this explanation and dismissed the summons against the firm. Mr. Gartside said there was an excessive amount of fines in the slack coal, so the automatic stokers did not satisfactorily distribute the fuel. He claimed that suitable fuel had been available.

Ronald Hamilton, the Valley Mill engineer, said that after the slack coal was delivered he made two complaints to the factors. In that particular week (of the January influenza epidemic), however, it was impossible for the factor to get transport to the Yorkshire colliery to obtain the regular small coal.

---

**Waiting for it**

Greenock Town Council have decided to shelve for six months at least their plant to make the burgh a smokeless zone in stages over the next ten years, because the development of a new high-grade smokeless fuel may make unnecessary the spending of about £475,000 on the adaptation and conversion of grates. During the six months council officials will obtain as much information as possible about the new fuel produced by the National Coal Board.—*Glasgow Herald*, April 22nd.

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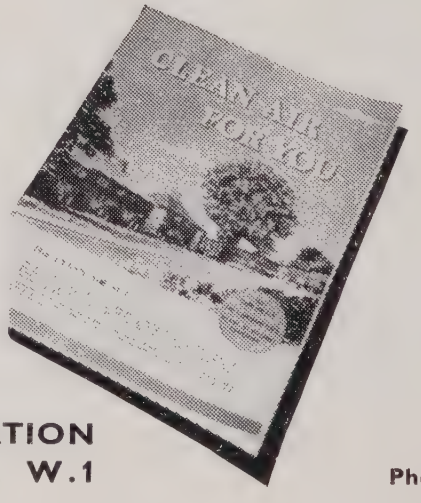



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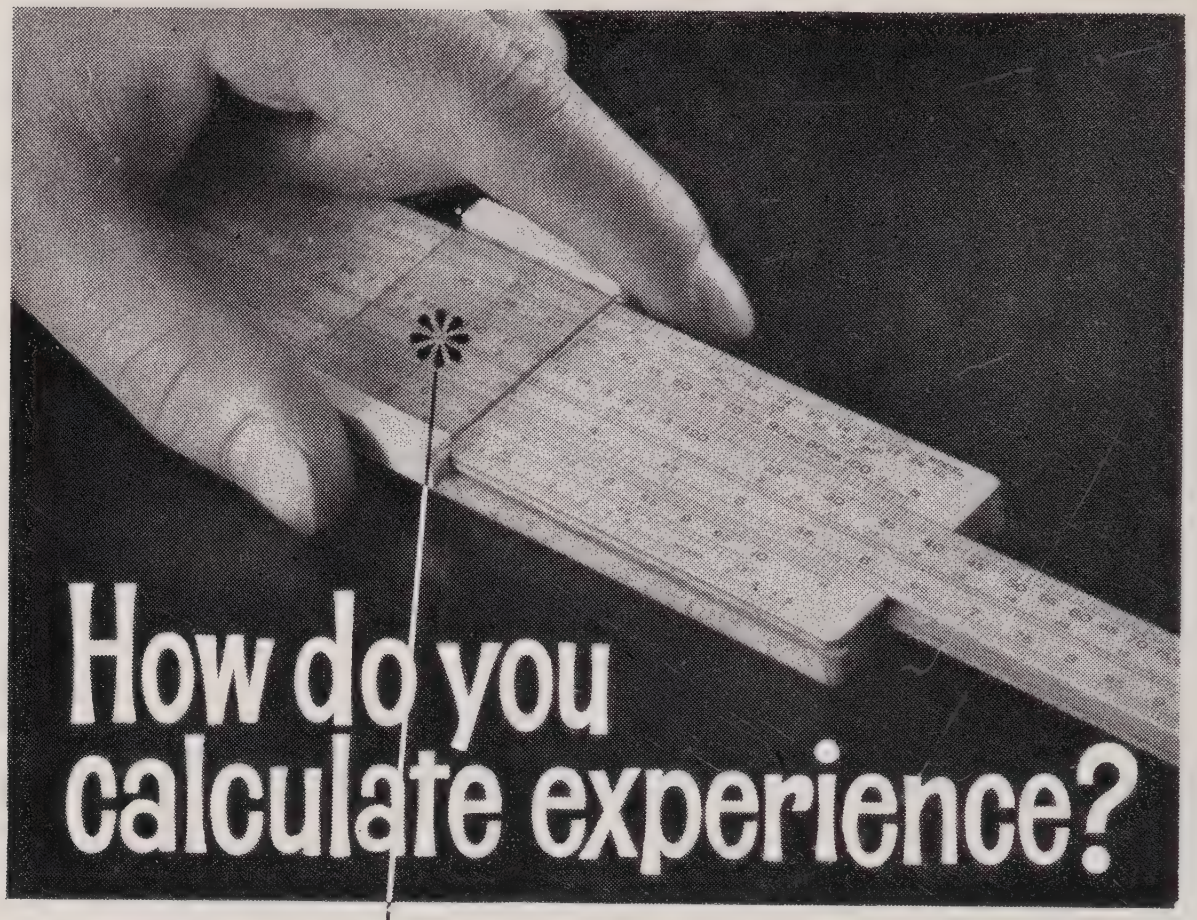



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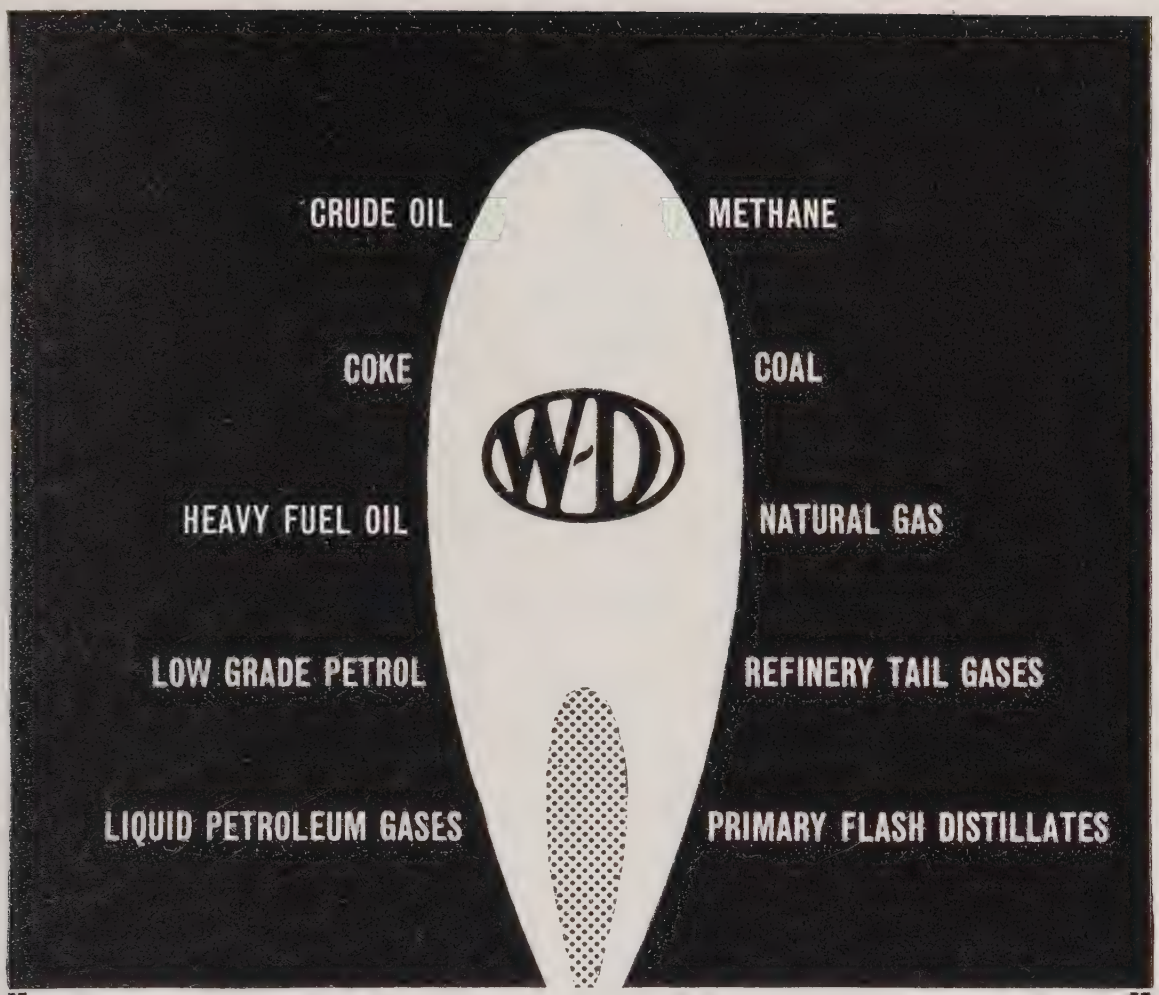
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# SMOKELESS AIR

JOURNAL OF THE
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No. 119 ★ AUTUMN 1961 ★ 2/-

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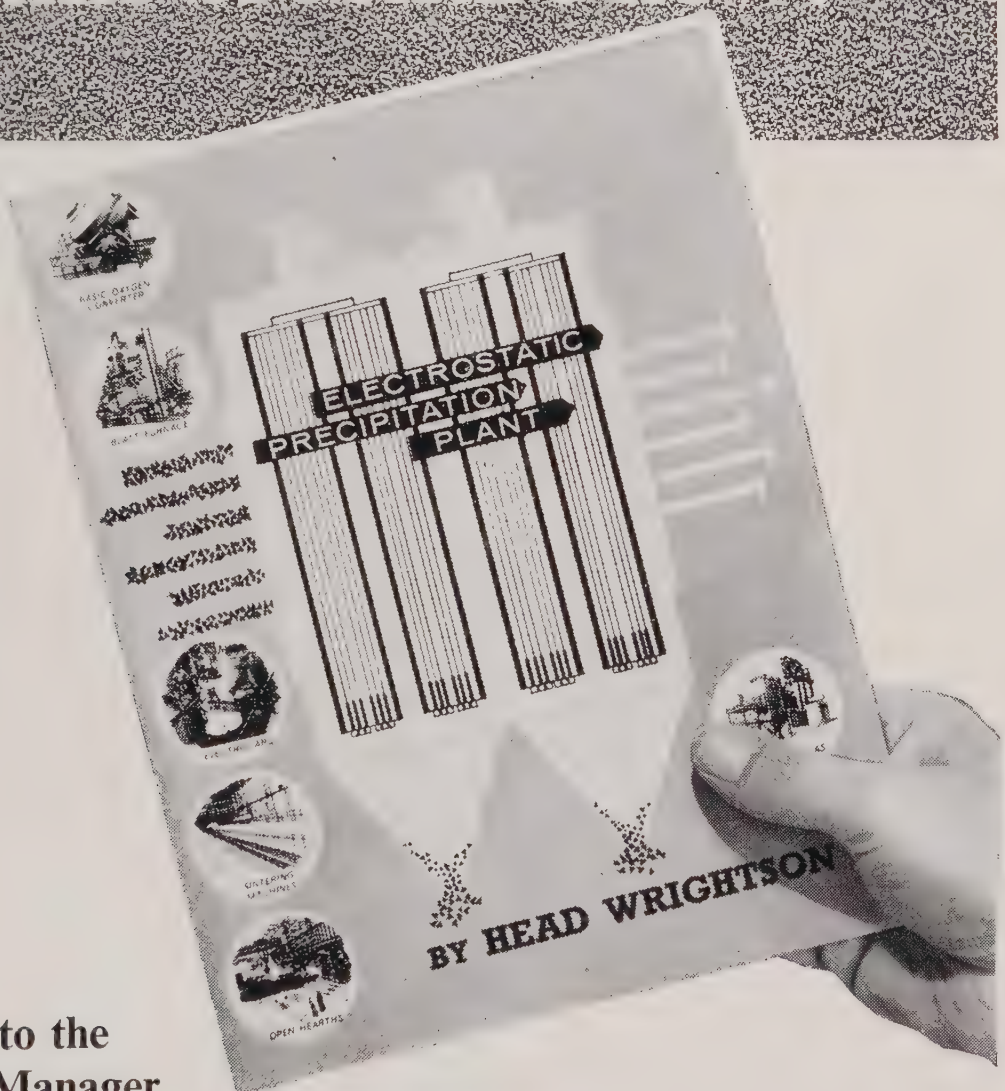
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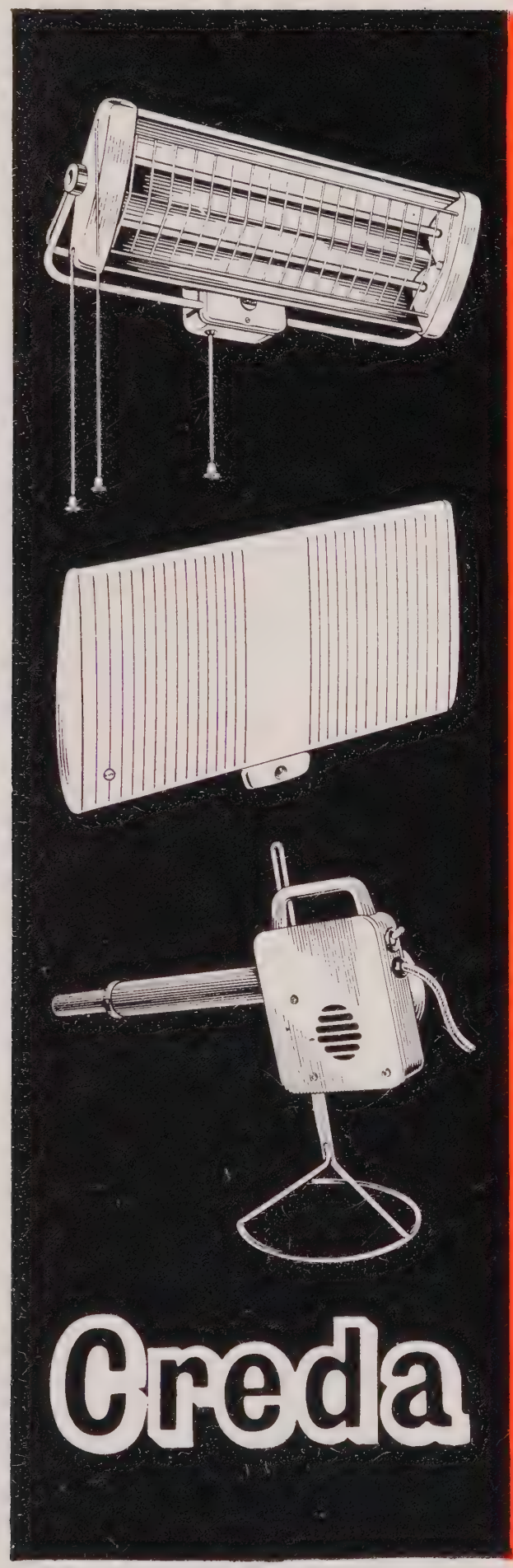
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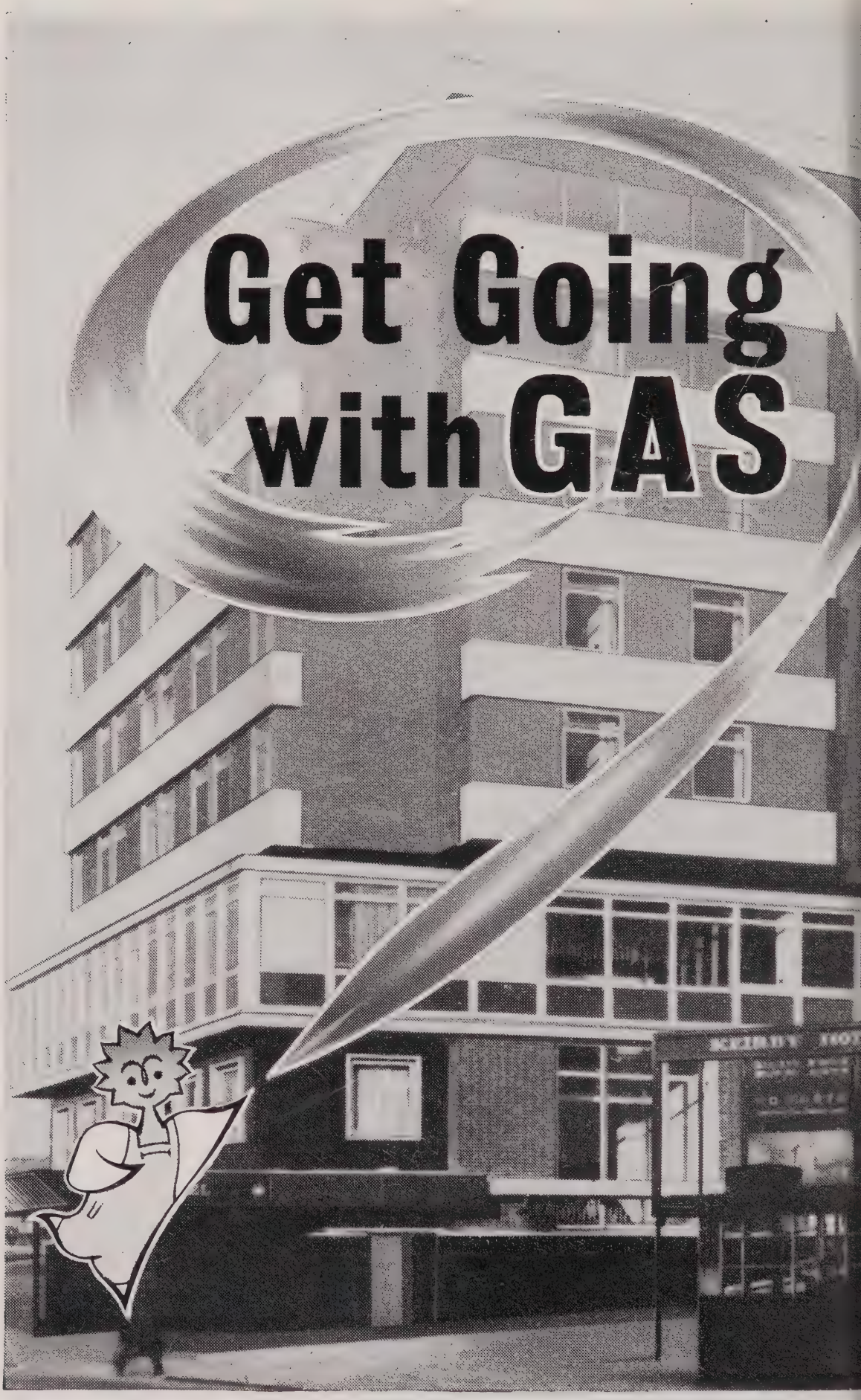
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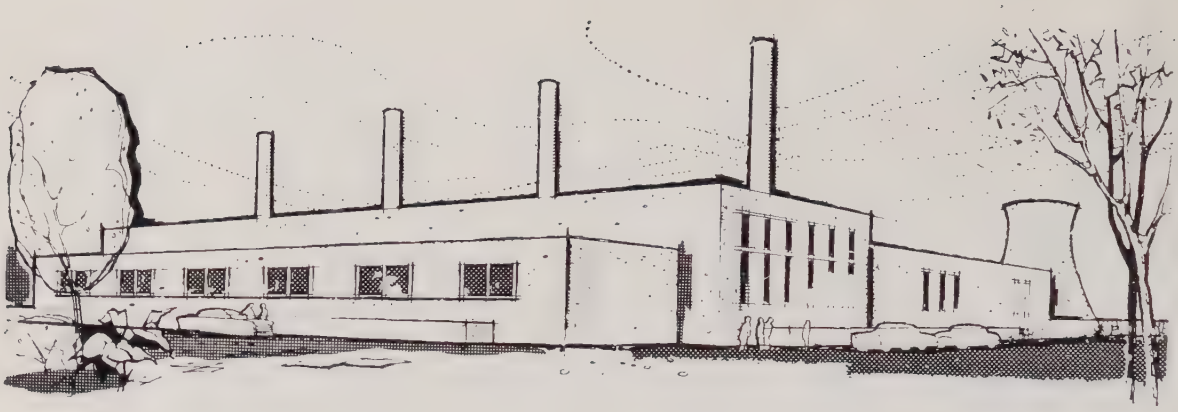


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# SERVICE

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*S.S.F.F. Exhibition Stand displaying approved solid smokeless fuel appliances under fire and the full range of authorised fuels*



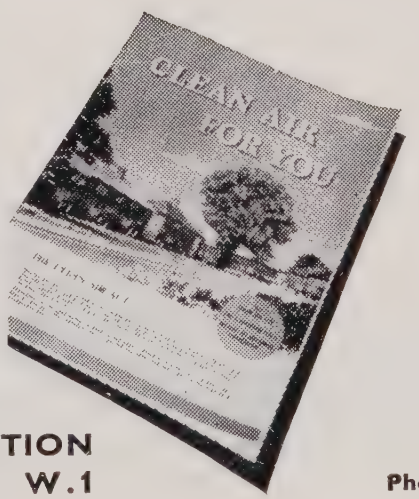



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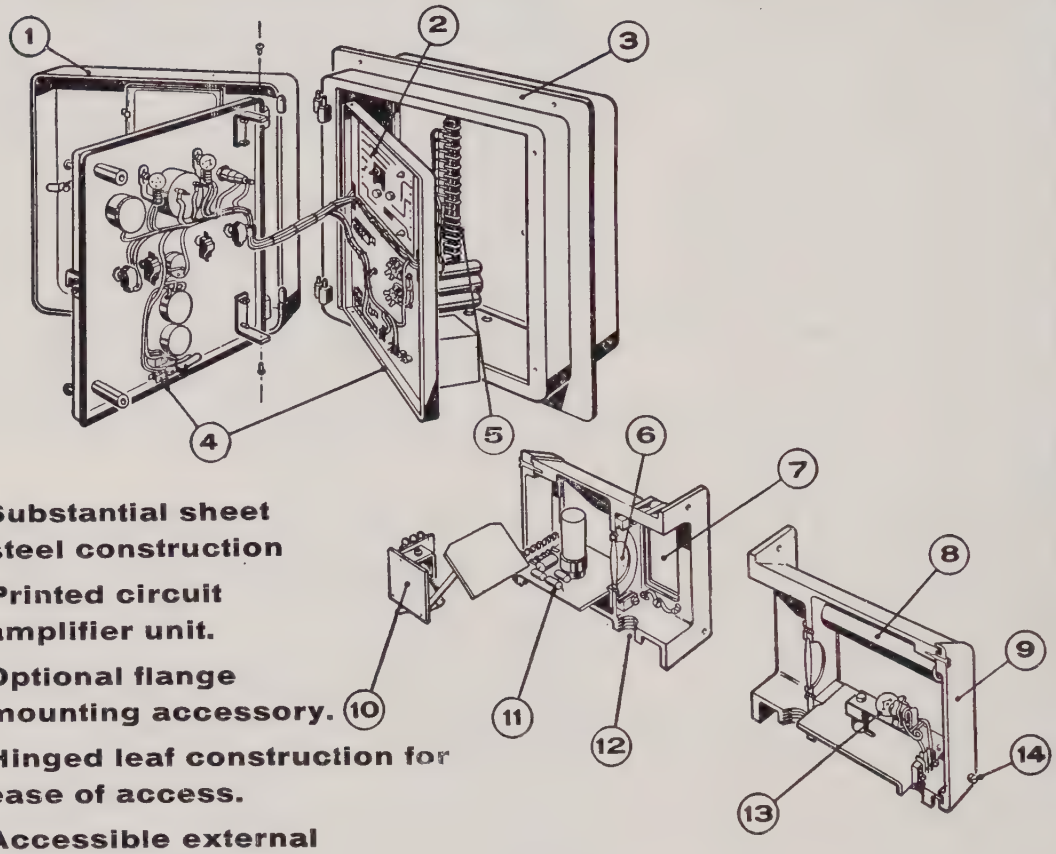
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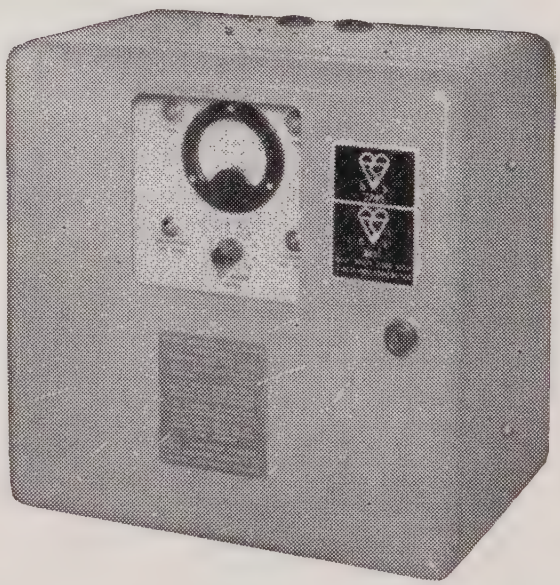
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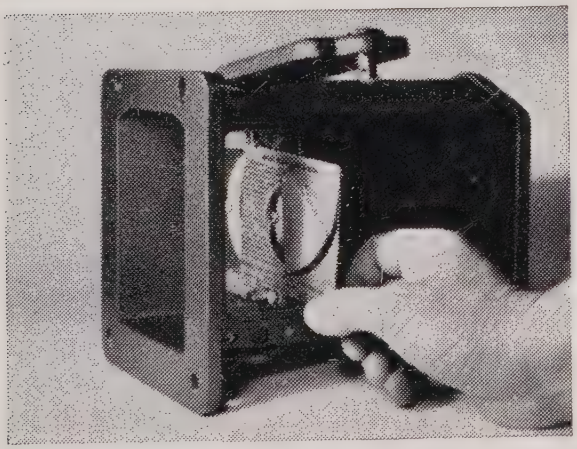
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*Main unit showing locked away controls and calibration meter.*



*Calibration check by manual insertion of check slide.*

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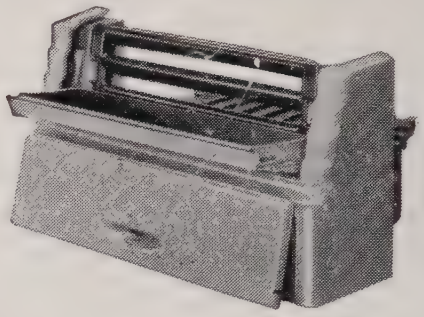
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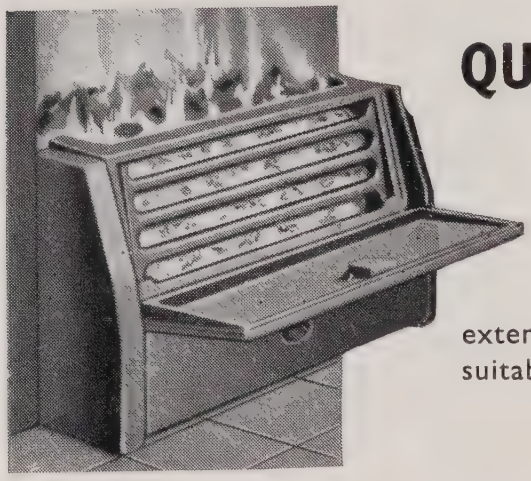
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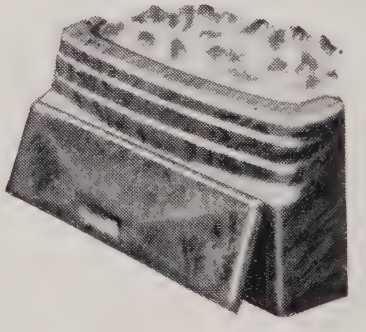


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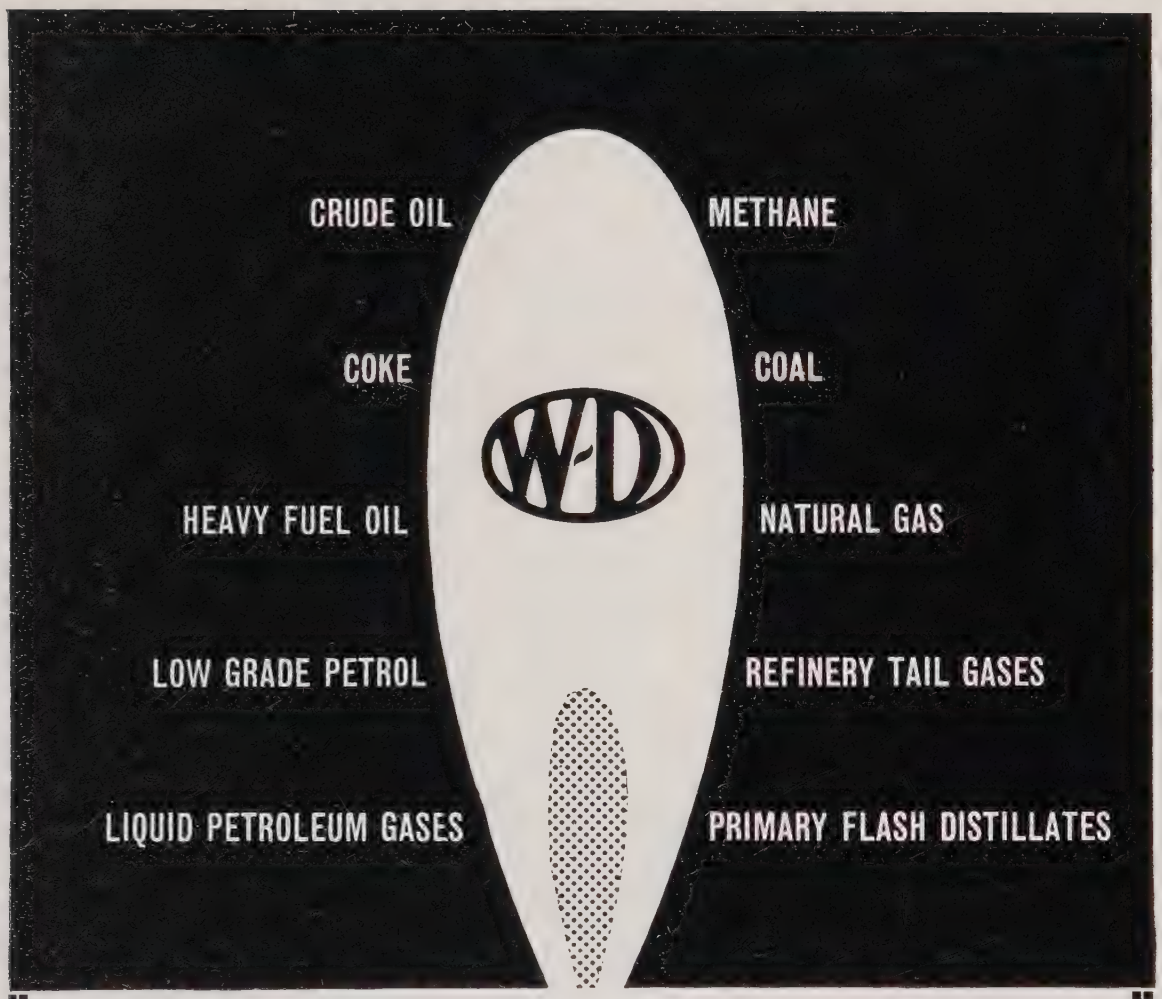
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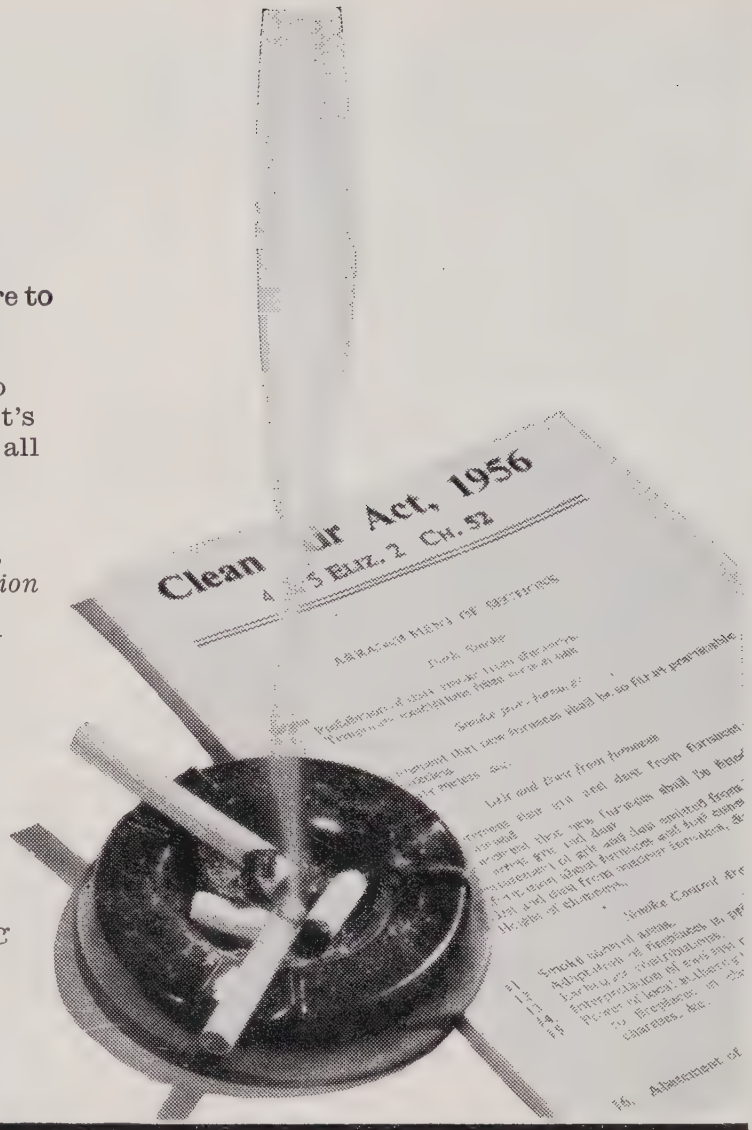
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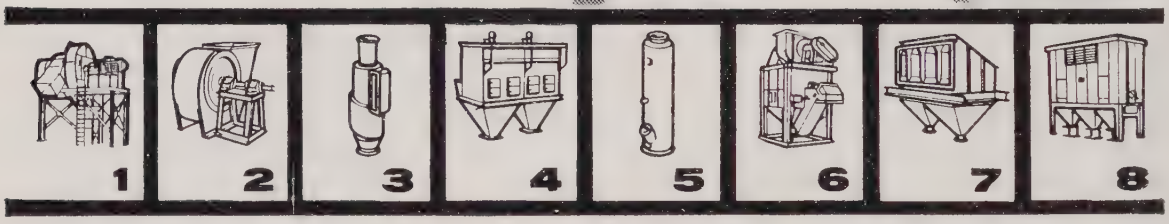
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MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application forms will be sent on request.

## *Notice to Members—Staff Changes*

Mr. H. C. F. Kapps has left the Society and Mrs. V. Finlay has been appointed in his place as Information Officer and Librarian.

Mr. L. Nevard is also leaving the Society, as from October 6th. An appointment is therefore shortly to be made to the position of Administrative (or Assistant) Secretary (male) to the Society. Members and readers are invited to draw this notice to the attention of anyone they know who might be interested.

The post will involve much responsibility for the management of the Society's business, including Council and Committee and other organizational duties. Not essential, but an advantage, would be a knowledge of air pollution, fuels, etc., and/or experience in editorial and publishing work. Ability to assist, and to deputise for, the Director will be desirable. Particulars of salary, non-contributory pension scheme, and other information from the Director on request.

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# SMOKELESS AIR

Vol. XXXII No. 119 Autumn 1961

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*Ships, towers, domes, theatres and temples lie*
*Open unto the fields, and to the sky;*
*All bright and glittering in the smokeless air.*

# SMOKELESS AIR

## *The Road Traffic Problem*

PUBLIC concern about the pollution on our roads, and especially the visible smoke from diesels, continues to grow. It is a nuisance that has a direct and immediate impact, and by obstructing visibility, depositing dirt on other vehicles and whatever is at the side of the road, and adding to the general traffic smell, it generates intense annoyance. It may be that as far as it affects health there is a greater hazard from the less obtrusive exhaust from petrol vehicles, and there is as yet little evidence that it is harmful to health.

It would be helpful if such evidence was available, but its absence in no way weakens the grounds for pressing for effective control on the simple grounds that it is a filthy and unnecessary nuisance and can be a danger to other road users.

There has also been little concrete evidence of a quantitative nature about diesel smoke, and we therefore welcome the report of a survey carried out by the Hornsey Corporation in conjunction with the Warren Spring Laboratory, on the level of pollution in the notorious Archway Road. This is published, with acknowledgements to the Corporation, on another page in this issue.

As will be seen, the measurements taken show the considerable excess of pollution levels in the road compared with the general pollution of the district. They also indicate that although the very local pollution may be very high, it is likely to have only a small effect on the general smoke pollution level caused by the burning of coal. This follows also from consideration of the relative amounts of coal and diesel fuel burned and the relative percentages of smoke produced. The estimates given in the *Clean Air Year Book* show 1·5 million tons of smoke from the burning of 188 million tons of coal, compared with 9·5 million tons of diesel oil and motor spirit producing what is given as a " small " weight of smoke. This is mentioned because it is important to keep the two problems in perspective, without in any way minimizing the seriousness of the smaller but more localized one.

The Society has been giving close attention to diesel smoke pollution, and the report (now published as a separate booklet) of the four papers and discussion from the Harrogate, 1960, conference, is one of the most useful publications available on the subject. Since Harrogate the question has been studied by the Technical Committee of the Society, which has held most helpful meetings with experts from the road transport organizations, motor manufacturers, and the oil industry. It is unfortunately not yet possible to report on the outcome of this study, but it may be possible for a policy statement of importance to be brought before the conference at Brighton in October.

## *On the Archway Road*

By pure coincidence, just before the Hornsey report was received, an attempt had been made to secure photographs of diesel smoke for this journal and other publicity use by the Society. Knowing the Archway Road to be the most likely place for such subjects, your Editor, armed with

camera, spent some two hours one warm June evening on the sides of the road, mostly where the hill runs up under the archway itself. The experience was perhaps more rewarding than the photographs obtained. It is during the evening that the goods vehicles stream out of London along the Great North Road on their long overnight journeys. The pull up the hill reveals their faults as far as smoke is concerned, but it has to be admitted that on this particular occasion the number of grossly smoking vehicles was quite small. It was in fact difficult to obtain photographs in which the smoke was thick enough to show up adequately in a print to be used for reproduction. Grey smoke against a grey road surface does not show a great deal of contrast. One of the best shots obtained is, however, reproduced on page 26.

The really bad cases noted were all labouring up the hill, obviously heavily laden, but if they were few there were plenty of vehicles that were emitting moderate smoke, continuously or intermittently. Also noticed was the number of taxicabs with unduly smoky emissions.

The road below the archway is in what is almost a cutting, and it was clear that in such places, as in narrow streets, the smoke and fumes disperse only slowly, and that with a constant stream of traffic there is a build-up of pollution that it is repugnant to smell and breathe, and which must create heavy deposits on roadside buildings and vegetation. It was in fact a relief to leave the road as the light began to go and seek fresher air and a remedy for a dry throat and unpleasant taste in the mouth.

## *The Mystery of Pollution Costs*

This journal has been rebuked, although only from Leamington, for its comments last quarter on Leamington's retreat from clean air. One thing that we do find disturbing about these strictures, which are reported on another page, is the statement that it is " perfectly ridiculous " for this journal to say that by not getting rid of smoke Leamington must continue to lose £400,000 a year.

It is disturbing because similar, though perhaps politer, views about the economic cost of air pollution are heard from time to time. The figures that are usually quoted are no doubt unexpectedly high to those who have not examined their basis, and it must be admitted that the clean air movement has not yet succeeded in explaining or stating the facts of the matter in a readily understandable way.

Take, as a handy and topical instance, this " perfectly ridiculous " figure for Leamington. It is simply the town's share of the £300,000,000 estimated by the Beaver Committee to be the annual national cost of air pollution (since declared by members of the committee to be a serious underestimate). The Committee's report (Appendix II) gave £5 to £10 per head as the individual annual cost, and allowing for the underestimate and the fall in money value since 1954, £10 per head is not too low an assessment for a town like Leamington, with a population of 40,000. Expressed as £400,000 a year for the whole town it may seem—to the uninformed—to be impossibly high; expressed as 3s. 10d. per head per week it seems much too conservative—at least to those who are aware of the many diverse costs, direct and indirect, that enter into the estimate.

To say that air pollution costs the people of a certain town so many pounds a year appears somehow to be sometimes taken to mean that this is a cost borne by the local authority and paid out of the rates. It is of course true that some of the cost does fall on the authority, but only as it falls on every business, industry, shop, hotel, and home. The 3s. 10d. comes out of the pocket of the individual. Much of it goes in his own direct costs (*e.g.* extra laundry), and some in the costs of others, which in the long run are paid for by the individual in his rates, taxes, fares, insurance contributions, and the commodities he buys.

The direct or original costs are diverse and not neatly compact and definite so that they can be readily visualized, while the way in which they are passed on to the individual is an added obstacle to comprehension. What it all amounts to is that air pollution, by the damage and waste it causes, and the labour it diverts from production and services, reduces the nation's real wealth by the sum of £300,000,000 or more, a year. Or perhaps we had better say the real wealth of the nation's inhabitants.

Appendix II of the Beaver Report is clear and convincing enough to the few who are willing to read it, but the many will never read it, or would not grasp it if they did. How to put over the economic facts of the case in a way that will make them seem to be of direct concern to every person, and to prevent them appearing to be mere abstractions, is something that we have not, as yet, achieved. But it is something that should be done as part of the programme of publicity and education needed to secure support and approval of clean air measures.

What these observations are leading up to are two requests to our readers: (1) to ask for comments and suggestions on the problem of " selling " the economic side of the clean air case to the public; and (2) to ask local authority readers in particular if they would welcome and be willing to purchase posters and leaflets on this important theme.

## *Brighton*

Arrangements for the Brighton conference, still some way off at the time of writing, are virtually complete, and registrations of delegates are coming in well. The transatlantic telephone link-up discussion, being planned with our friends at the Air Pollution Control Association of America, is already creating much interest, and should be a feature as informative as it is novel. Another novel feature—though it is not likely to affect delegates—is that the Society is holding a competition for senior schoolchildren in the district, to take the form of an essay written as a newspaper report of a visit to the Clean Air Exhibition which, as before, we are holding in conjunction with the conference. The Reception to be given by the Mayor of Brighton in the Royal Pavilion is to be held in two parts, on two evenings, because of the numbers to be invited. For their free evening delegates will have the opportunity of seeing a (free) show of films of clean air interest.

## *Report on Gas*

Just as we go to press the Report of the Select Committee on Nationalized Industries, on the Gas Industry, has been published. (H.M.S.O., 6s. 6d. net). It is a report of considerable interest from the clean air viewpoint and it is hoped to review it more fully in our next issue. In the meantime, attention may be drawn to the proposal for a central generating board for the industry, similar to that for electricity, and the attention that is given to the underground storage of gas to help to meet the winter load. The latter development could materially assist in promoting the greater use of gas in the main space-heating field and thus lessen the danger of solid smokeless fuel shortages as smoke control develops. Coke is discussed with reference to clean air, but the greater part that it can play does not appear to be directly mentioned. The style in which the report is written is at times decidedly and refreshingly brisk and informal and all who are interested in the nation's fuel problems and policies will find it an invaluable source of information—almost a textbook, in fact, on gas in the 1960s.

---

**Institute of Fuel.**—Dr. James Burns, G.M., Deputy Chairman, North Thames Gas Board, has been elected President of the Institute of Fuel, to take office in October, 1961.

# SMOKE CONTROL AREA CONVERSION GRANTS

## *Not to be Payable before Confirmation of Order*

The Society and, it is understood, other organizations, have made proposals to the Ministry of Housing and Local Government that conversions of appliances in smoke control areas would be facilitated if grants were payable before the confirmation of an order. The Society's conference in 1959 passed a resolution to this effect, and more recently it had been suggested that such grants in advance might be acceptable if restricted to areas which it was intended to establish as smoke control areas within three years.

The Ministry has now considered these representations and with a letter on the subject to the Society has enclosed a note explaining their reasons for rejecting the various suggestions. This is reproduced, with permission, as follows:

*The Note*

1. The Clean Air Act, 1956, provides for the payment of grant on approved expenditure incurred by owners or occupiers of private dwellings (not being " new dwellings " as defined in the Act) in order to avoid contravention of a smoke control order, in other words, in order to permit the use of smokeless fuel. The Act provides that grant shall be paid only on approved expenditure incurred in the period between the confirmation of an order and its coming into operation, a period which the Act requires to be not less than six months. Thus grant cannot be paid on expenditure incurred before an order is confirmed.

2. A number of representations have been made to the Ministry of Housing and Local Government that these provisions discourage householders from switching over to smokeless fuels before smoke control orders covering their houses have been confirmed, and also that it is difficult for the public to understand why some householders can get grant and others not. It has been represented that the Act should be amended to permit earlier payment of grant to owners or occupiers of private dwellings (other than " new dwellings ").

3. A wide variety of suggestions have been made about possible amendment. For example, it has been suggested that grant should be payable whenever householders convert to appliances capable of smokeless operation; or on such conversions in the black areas; or in those parts of the black areas which it is proposed should be covered by smoke control orders within a given period of say five years; or in areas, whether black or not, which it is proposed to cover by smoke control orders within a given period. There is no uniformity of opinion as to whether grant in such cases should be tied to a legal obligation to use only smokeless fuels in the appliances (which would often be capable of burning either coal or smokeless solid fuels). Others have suggested that local authorities should be enabled to *approve* expenditure in advance but that grant on such expenditure should become *payable* only after the confirmation of a smoke control order.

4. The Department have considered very carefully all the suggestions made, which they appreciate have been put forward with the object of facilitating progress with smoke control.

5. The concept of grant to house holders under the Clean Air Act is that the confirmation of a smoke control order imposes on householders a legal obligation not to make smoke and that it is reasonable and proper to help householders with the expenses

they have to incur to meet this new obligation. In the Department's view it would in principle be wrong to pay grant without imposing and enforcing the legal obligation. In a smoke control area all houses are subject to the legal obligation and enforcement is related to a compact and coherent area. Outside smoke control areas it would seem virtually impossible to enforce such an obligation on scattered individual houses, and attempts to do so would be calculated to divert the time and energies of local authority staff from the much more important work of establishing further smoke control areas.

6. Many of the suggestions made tacitly assume that the present programmes of smoke control drawn up by local authorities will not subsequently be changed. While this may prove substantially correct in many cases, the programmes have no binding statutory or other legal force and are capable of being altered by subsequent decisions of the councils concerned. They therefore do not offer a suitable basis for legal commitments, such as an undertaking to pay grant at some subsequent date. Similarly, while the broad pattern of the black areas is well known and not in dispute, the Department's list of local authorities whose areas may be regarded as black areas in whole or in part is a provisional list and must remain a provisional list for some time to come. The possibility of some amendment of the provisional list cannot be excluded, so that the list would likewise not offer a suitable basis for legal commitments.

7. The Department have therefore reached the conclusion that it would not be practicable to consider amending the grant provisions of the Act in any of the ways suggested.

# Ministry Circulars on the Clean Air Act

### Grates for Coke Burning

The Ministry of Housing and Local Government has issued a circular to local authorities (No. 28/61, 5 June) on the selection of open fires for coke-burning. The circular states:

"I am directed by the Minister of Housing and Local Government to say that when advising householders in smoke control areas on the selection of fires for coke burning, local authorities should draw their attention to the importance of installing firebars sufficiently widely spaced to enable coke to be burned satisfactorily. Information on the appropriate spacing for firebars is given in the notes at the head of the open fire section of the 1961 edition of the List of Approved Domestic Solid Fuel Appliances, published jointly by the Coal Utilization Council and the Solid Smokeless Fuels Federation.

"Local authorities will be aware, from paragraph 26(4) of the Department's Memorandum on Smoke Control Areas, that in appropriate cases the replacement of firebars with ones more suitable for coke burning rank for grant."

The essential point of this is that in some of the improved grates that have been installed the fire bars are a half-inch apart, whereas for the satisfactory burning of coke or Gloco or similar fuels it is necessary that they be five-eighths inch apart.

### Electric firelighters

A circular dated 26 June (No. 31/61) refers to the Ministry's Memorandum on Smoke Control Areas, which had stated that expenditure eligible for grant in conversions might include the provision of gas ignition to open fireplaces. The circular continues:

"At that time methods of electrical ignition had not been developed. Now they have been, and accordingly paragraph 26(10) may now be read as including a reference to electrical means of igniting coke and other smokeless solid fuels.

Reasonable freedom of choice between gas and electrical ignition should be given to owners or occupiers provided that in any particular case the total cost of the alternatives is broadly comparable."

The circular continues by reminding local authorities that under para. 29 of the memorandum approval of local authority expenditure for the payment of the Exchequer contributions is conditional on electrical appliances being selected from the list of "Recommended Domestic Electrical Appliances" compiled by the Electrical Development Association.

The Minister does not, it is stated, at present wish to revise the guidance given to local authorities in the Department's Circular No. 28/60 about the use of sticks and paper for lighting fires in smoke control areas.

**Stoves in the Northern Region**

As reported in our last issue, the Minister has decided that in smoke control areas in those parts of the Northern Region where the smokeless open fire fuels are scarce, grants may be paid on closed stoves which will burn hard coke. This information was based on a reply to a Parliamentary question by the Minister of Power on May 18th. The Ministry of Housing and Local Government has now sent to all local authorities in the Northern Region a letter amplifying this statement. The text of the latter is as follows:

1. I am directed by the Minister of Housing and Local Government to refer to the Report of the Committee on Solid Smokeless Fuels (Cmd. 999 of 1960) and to the Parliamentary statement made about it by the Minister of Power on May 18th.

2. Your Council will note from the statement, the text of which is annexed, that the Government is discussing with the producers the best way of ensuring that supplies of open fire smokeless fuels will be available in the Northern Region when they are needed.

3. Meanwhile large stocks of hard coke unsuitable for open fires but suitable for closed and openable stoves are available in the Northern Region.

4. Closed and openable stoves are highly efficient appliances for heating rooms for many hours at a stretch. Although initially they cost more than open fires they use less fuel and give out more heat.

5. Under section 14(1) of the Clean Air Act only such works of adaptation are eligible for grant as are "reasonably necessary" to make suitable provision for smokeless heating and cooking in smoke control areas. In view of their greater initial cost stoves are not normally to be regarded as "reasonably necessary" solid fuel replacements for existing open fires. If they are installed grant is normally calculated on the national cost of simpler replacements, such as open fires designed for smokeless fuels.

6. Section 34(6) of the Act, however, provides that in considering what works are "reasonably necessary" regard shall be had to any difficulty in obtaining fuels which would have to be used if the works were not executed.

7. It is now in the interests of the clean air drive to encourage the use of hard coke as an alternative to other solid smokeless fuels in certain parts of the Northern Region. The Minister will therefore in future, for the purposes of grant under the Clean Air Act, treat the replacement of existing appliances by closed and openable stoves as "reasonably necessary" in Northumberland and Durham and in those parts of Cumberland, Westmorland and the North Riding of Yorkshire which are within the area of the Northern Gas Board.

8. The installation of stoves may affect the make-up or total of estimated costs of smoke control orders now before the Minister or of estimated costs approved by the Minister in respect of smoke control orders confirmed but not yet operative. In such cases a full explanation should be submitted with the schedule of final costs. Estimated costs of orders submitted after the receipt of this letter should take stoves into account.

9. Where simpler solid fuel appliances or conversions of existing solid fuel appliances are nevertheless preferred to stoves the cost of such works will remain eligible for grant on the same conditions as at present. Similarly, grant will be payable on the same conditions as at present on appliances burning fuels other than solid fuels. Grant on the cost of installing stoves cannot be paid where alternative works have already been executed with the benefit of grant.

10. Where works are eligible for grant under the Clean Air Act in the areas

referred to in paragraph 7 the Minister hopes that local authorities will encourage householders who intend to burn solid fuel to consider replacing existing appliances by stoves and will themselves consider similar action in local authority housing. They may wish to consider whether there are any steps they can take, such as demonstrations of stoves in local authority housing or elsewhere, to draw public attention to the merits of stoves and to the availability of grant for installing them in smoke control areas.

11. This letter is being addressed to all local authorities in the Northern Region.

## NEW DIESEL SMOKE REGULATION

Regulations to reduce diesel vehicle smoke by controlling the use of the excess fuel device, which has for some time been under discussion, has now been issued and will come into force from January 1st, 1962 (Motor Vehicles (Construction and Use) (Amendment) Regulations, 1961. S.I. No. 1961/1313; H.M.S.O., 3d.).

The new Regulations will make it an offence for the device to be kept in operation once the engine has started or to be used while the vehicle is in motion. From that date, also, on all new vehicles, the control for operating the device must be placed where it cannot be operated by the driver while the vehicle is in motion, unless it is automatically shut off when the engine is running. Existing vehicles will have to be adapted to meet this requirement by July 1st, 1962.

The device is fitted to diesel engines to assist in starting from cold by injecting extra fuel, but has often been used by drivers to gain extra power, especially when overtaking or ascending hills, often producing dense black smoke.

# *" Smokeless Air " Criticized*

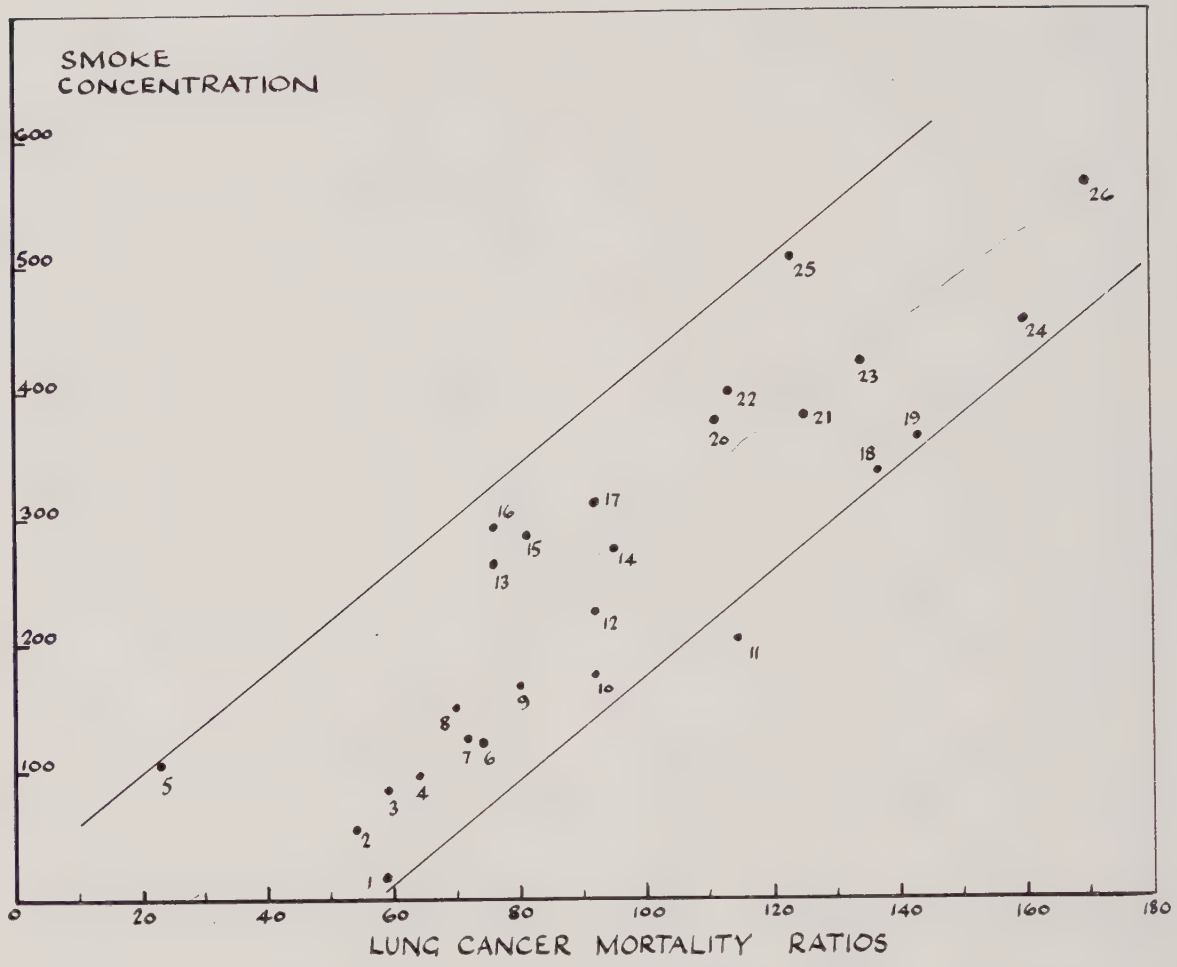
The report headed " The Leamington Case " in our last issue has been sharply attacked by three speakers in the Leamington Borough Council recently. The article was said to be insulting, that it had irritated one speaker intensely, and that the statement about the cost of smoke to Leamington was " perfectly ridiculous."

The last allegation is discussed, in wider context, in an editorial note. The charge of insulting seems to stem from the remark that " it would seem that an insidious infection of public opinion, carefully fostered, took hold in Leamington and spread into the Council chamber itself." We would suggest that this should be read in conjunction with the statements made at the meeting of the Warwickshire Clean Air Council reported immediately following our own report.

The Warwickshire Clean Air Council —which is of course a local authority organization, and which includes Leamington among its constituent members—has also been reproached for its criticisms. It is reported in the Press that at its annual general meeting on July 20th (which happened to be in Leamington) " the row over Leamington Corporation's smokeless zone policy took up most of the first half hour." According to the *Leamington Courier* Alderman Edwin Fryer said he had been against the Clean Air Act from the start. Criticism had been levelled at the Corporation for going back on its original policy, but they had got to be realistic and practical.

" When you are going to change the Englishman's way of life you can't do it in a hurry," he is reported to have said. " Coal is part of the Englishman's life. This has got to be done very, very gradually if you are going to achieve results." (It was Alderman Fryer who said our report was " very impudent ").

# THE CORRELATION BETWEEN SMOKE AND LUNG CANCER




The above diagram is based on figures from two of the tables in the report by Dr. Percy Stocks on "The Relations between Atmospheric Pollution in Urban and Rural Localities and Mortality from Cancer, Bronchitis and Pneumonia, with Particular Reference to 3:4 Benzopyrene, Beryllium, Molybdenum, Vanadium and Arsenic," published in the *British Journal of Cancer* (14, 3, Sept. 1960, 397-418). The report was reviewed, and the author's summary quoted, in *Smokeless Air*, Spring 1961, No. 117.

The report contains the most important evidence so far available on smoke, etc., as a causative agent in lung cancer, bronchitis and pneumonia.

The diagram has been prepared after consultation with Dr. Stocks and is reproduced with his consent. It is based on smoke concentration figures given in Table II of the report (in mg./1000 cu. m.) and the lung cancer mortality ratios in Table III, for the 26 localities at which observations were made.

The diagram shows more clearly than do figures the strong correlation between smoke and lung cancer mortality.

The numbers against the points on the diagram relate to the localities according to the following key:

1, Conway Valley. 2, Llangefni. 3, Tattenhall (Tarvin R. D.). 4, Wetherby. 5, Ruthin. 6, Blaenau Ffestiniog. 7, Ripon. 8, Elland. 9, Flint. 10, York. 11, Chester. 12, Ormskirk. 13, Wrexham. 14, Lancaster. 15, Darwen. 16, Keighley. 17, Burnley. 18, Birkenhead. 19, Bootle. 20, St. Helens. 21, Warrington. 22, Gateshead. 23, Leeds. 24, Liverpool. 25, Newcastle-upon-Tyne. 26, Salford.

# ROAD TRAFFIC SMOKE MEASUREMENTS

## *Archway Road Survey*

AN important report has been issued by the Borough of Hornsey on a survey carried out, in conjunction with the Warren Spring Laboratory, D.S.I.R., on the smoke pollution due to road traffic in Archway Road. This road is the first stretch of the Great North Road, and is one of the most heavily burdened, especially with heavy goods vehicles, of any in the country. The ascent of Highgate Hill—between Archway and Highgate Underground stations—leads to considerable emissions of smoke from diesel vehicles. (See also editorial note on page 17).

There are few, if any, figures of the kind now made available through this investigation, and appreciation should be expressed to the Hornsey Corporation for carrying out an inquiry that is of considerable value to the clean air cause.

The survey was made between August 26th and October 17th, 1960, and the Report, with its Appendix is as follows:

### Sampling Points

Measurements of the hourly mean concentration of smoke at a height of 10 feet above the ground were made at a point in the building line beside Archway Road opposite the Highgate Underground Station; another set of measurements of concentration at the same height were made at a point 100 yards from the main road in the grounds of the Library in Shepherds Hill in order to provide information on the " background " concentration due to sources other than traffic. All measurements were made by passing a sample of air through a white filter and measuring the darkness of the stain produced. The figures given can therefore be taken as relative amounts of " black smoke."

### Background Concentration

The background concentration of 30 microgrammes per cubic metre is very similar to measurements made in neighbouring boroughs (allowing for some difference in ventilation) and may be regarded as a true measure of the pollution in the area. The mean pollution on weekdays (Monday–Friday) at the Archway Road site is, however, 360 microgrammes per cubic metre—i.e. twelve times the background, and this additional pollution can only be due to traffic.

On weekdays, there are two maxima in the pollution due to traffic between 6 a.m. and 9 a.m. and between 7 p.m. and 10 p.m., the highest figures being observed between 7 a.m. and 8 a.m. when the mean concentration at Archway Road was 750 microgrammes per cubic metre, while at the library it was only 40 microgrammes per cubic metre.

### Traffic Flow and Smoke Concentration

On a Tuesday and a Sunday during the survey, a census of road traffic was carried out at a point near the site of the measurements and these indicate that the variation during the day did not agree with the variation in the number of diesel vehicles passing (which does not vary much between 6 a.m. and 8 p.m.) The variation in concentration of pollution agreed in fact much better with the variation in total number of vehicles passing. This need not be taken to imply that all vehicles contribute equally to the pollution since the amount of smoke emitted by a diesel vehicle will be



*On the Archway Road—see page 17*

greater in periods of traffic congestion when it is subject to frequent halts. There will also be some dependence on weather conditions—a separate study indicates that the pollution to be expected with a wind speed of 15 knots is only one-third of that at 5 knots. We may, however, eliminate both these variables to a large extent by comparing pollution on weekdays and on Sundays. From 10 a.m. to 8 p.m. there is approximately the same number of vehicles on both days, but far fewer diesel vehicles on the Sunday, and correspondingly lower pollution which shows conclusively that diesels are responsible.

**Layers of Pollution**

A few additional measurements were made at a height of six feet, at the edge of the carriageway at a series of points along the road; these indicate that there was not a very large change in concentration across the pavement, and that very similar concentrations are observed for some distance along the road. Another set of measurements made at different heights above the ground showed that there was little difference down to about 4 feet, but that concentrations at a height of 2 feet are about 50 per cent. higher. Some measurements were also made on the road behind "smoking" vehicles by means of a motor cycle and these indicated concentrations as high as 10,000 microgrammes per cubic metre, although 3,000 to 5,000 was more common.

**Inhalation Risks**

It is interesting to note that the amount of air drawn through the filter paper in one hour during the survey was approximately 2·5 cubic feet, the equivalent of 71 litres and that an average adult when walking at about 3 miles per hour inhales at the rate of 25 litres per minute. One of the hourly smoke stains, therefore, indicates approximately the amount of smoke which might be inhaled in three minutes by a person walking up Archway Road.

**Conclusion**

The average smoke pollution on weekdays in the Archway Road is approximately twelve times the background pollution of the district measured at ten feet above ground level. This pollution is shown to result from diesel vehicles in heavy traffic conditions. A greater concentration is found below 2 feet from the ground.

## APPENDIX

*N.B.: All readings are shown in microgrammes per cubic metre*

**Smoke concentration: Readings during hours of heavy concentration**

| *Date* | *Time* | | *Archway Road* | *Shepherds Hill* |
|---|---|---|---|---|
| | *a.m.* | *p.m.* | | |
| *August* | | | | |
| Wed. 31st .. .. .. | 7–8 | — | 1,120 | 30 |
| *September* | | | | |
| Tue. 6th .. .. .. | 6–7 | — | 1,200 | 60 |
| Wed. 7th .. .. .. | 7–8 | — | 1,480 | 10 |
| ,, ,, .. .. .. | — | 7–8 | 1,330 | 50 |
| Thur. 8th .. .. .. | 6–7 | — | 1,870 | 180 |
| Tue. 13th .. .. .. | 7–8 | — | 1,080 | 20 |
| Thur. 15th .. .. .. | 7–8 | — | 650 | 40 |
| Fri. 16th .. .. .. | 11–12 | — | 810 | 70 |
| Mon. 19th .. .. .. | 9–10 | — | 1,040 | 60 |
| Wed. 21st .. .. .. | — | 9–10 | 770 | 30 |
| Fri. 23rd .. .. .. | — | 8–9 | 760 | 30 |
| Mon. 26th .. .. .. | 6–7 | — | 610 | < 10 |
| Tue. 27th .. .. .. | 7–8 | — | 910 | 20 |
| *October* | | | | |
| Tue. 4th .. .. .. | 7–8 | — | 1,360 | 70 |
| ,, ,, .. .. .. | — | 8–9 | 1,620 | 450 |
| Wed. 5th .. .. .. | — | 9–10 | 1,060 | 80 |
| Fri. 7th .. .. .. | — | 9–10 | 1,210 | 110 |
| Mon. 17th .. .. .. | 7–8 | — | 1,440 | 280 |
| ,, ,, .. .. .. | 11–12 | — | 1,600 | 680 |

**Comparison of Recordings**

During past years 68 London sites showed overall averages for smoke concentrations as follows:

| | |
|---|---|
| Summer (April to September) .. .. .. .. .. | 100 |
| Winter (October to March) .. .. .. .. .. | 310 |
| Yearly (April to March) .. .. .. .. .. | 209 |

Sample results under special atmospheric conditions were as follows:

5th-8th December, 1952—The Great London Smog.

The average concentration in the Thames Valley was 3,750.

At Woolwich figures of 5,430 and 5,220 were recorded.

During November, 1959, hourly readings were taken at Greenwich during light fog conditions and the maximum reading obtained over three days was 3,600.

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**Scottish Comment**

In the Report of the Department of Health for Scotland, 1960, it is said with reference to smoke control: "Although Scotland has one of the highest death rates from bronchitis in Europe, and although the Clean Air Act has been in force for over four years, the number of houses covered by smoke control orders is only 19,000; there are 900,000 houses in the industrial belt alone."

# INTERNATIONAL SECTION

## CONFERENCE AT NEW ORLEANS

*Third Air Pollution Research Seminar*

TO further the exchange of information on current research, methods and findings in the field of air pollution the Public Health Service of the U.S. Department of Health, Education, and Welfare sponsored the Third Air Pollution Research Seminar held in New Orleans on March 22nd-24th, 1960. The 81 papers given are not being published together, but the Public Health Service has issued a report in the form of summaries of the papers, from which the following account has been prepared.

**International Aspects**

Dr. Christian E. Junge, Air Force Cambridge Research Centre, Bedford, Mass., discussed the continental and global aspects of air pollution. He said that the concentrations of two atmospheric constituents, carbon dioxide and sulphur dioxide, have increased on a global scale as a result of human activity. Any fluctuations in $CO_2$ concentration will have a profound influence on world climate. While the $CO_2$ concentration has increased but 10 per cent. since the age of industrialization, it has been estimated that the increased use of energy by the turn of the next century may result in an alarming $CO_2$ concentration in the earth's atmosphere. The sulphur concentration has increased much more because of the lower natural level in the earth's atmosphere. Recent measurements of sulphate in rainwater show higher concentrations in inland and north-eastern parts of the United States, which may be associated with comparable industrial activity, Dr. Junge said. Because of the complex "washout" mechanism, care must be taken in interpretation of rainwater concentration in relation to air concentration; broadly speaking, however, air concentration and rainwater concentration are parallel. On a global basis, 30 per cent. of the sulphur "injected" into the atmosphere is a result of human activities.

Dr. Morris Katz, Department of National Health and Welfare, Ottawa, discussed air pollution from common gaseous and aerosol contaminants in various parts of the country. Studies involving industrial emissions concern the pollution of the atmosphere by fluorides, hydrogen sulphide, sulphur dioxide, and organic sulphides. An assessment of the components of exhaust gases from locomotive diesels, considering various operating conditions and fuel types, has been undertaken. An assessment is being made of the carcinogenic hydrocarbons and other organic compounds in smoke and particulates of urban air and in automobile and diesel exhaust gases. A national air sampling network is being organized to correlate and exchange data. A meteorological tower has been equipped in Ottawa, together with a number of air sampling stations throughout the city; data will be correlated with source evaluations within each city block.

Arthur C. Stern, Air Pollution Division, Robert A. Taft, Sanitary Engineering Center, Cincinnati, Ohio, described air pollution research in Europe. In Great Britain, he said, air pollution research efforts are concentrated on the smokeless combustion of solid fuels, development of smokeless fuels, behaviour of steam power plant

stack fumes, etiology of chronic bronchitis, and the general problem of sulphur oxides in the air. In West Germany, a large research programme has been initiated, with emphasis on the $SO_2$ cycle (formation, emission, diffusion, and effects on vegetation), the measurements of air pollution, the meteorological parameters associated with pollution dispersion, and the properties of dusts and aerosols. The major research effort in Belgium is related to air pollution effects upon vegetation and upon man, measurements of air quality, and meteorological and climatological aspects of air pollution. The major activities in Italy are studies of carbon dioxide, sulphur dioxide, and particulate matter, and investigations of lead and polynuclear hydrocarbons. The major research in France relates to the measurement of air quality in the city of Paris. Air pollution research effort in Europe is comparable to that in the United States in size and scope. In the United States, research results are rapidly disseminated; in Europe, however, language and political barriers not only impede dissemination of results but lead to duplication of effort.

*U.S.S.R. Research*

Dr. Benjamin S. Levine of Washington, D.C., reported on air pollution research in the U.S.S.R. Research in air pollution began some time ago in central and widely scattered sanitary hygienic and occupational health institutes. At first, attention was centred almost entirely on workroom, shop, and production plant air. Community air pollution research was initiated some years later, and standard allowable limits were adapted on an arbitrary, but temporary basis. Without waiting for results of time-consuming investigations, limits of allowable atmospheric air pollution were accepted as one-third of the limits adopted for factory air for corresponding pollutants. As research progressed and rational data were accumulated, arbitrary standards were amended or replaced. In addition to clinical research and experimental animal studies, research has been undertaken which relates to the development and application of methodology for air pollution measurement. The general approach has been to assign the investigation of a given pollutant to a specific institute. The institute was expected to study all aspects of the pollutant—its sources, concentration, and pathophysiological effects—and to recommend a safe limit of emission into the atmospheric air. In the development of allowable limit concentrations for specific pollutants one unique aspect of Soviet research has been the application of aberration measurements of conditioned reflexes during experimental exposure of animals to different pollutant concentrations. By these and other methods limits of allowable concentrations have been set for 30 industrial air pollutants in the U.S.S.R.

*Sampling and Measurement*

Various papers on sampling and measurement were then given including one by Dr. Walter C. McCrone, Walter C. McCrone Associates, Chicago, who reported on the characterization and identification of smoke and fly ash by means of the microscope, a study in which various types of particulate air pollutants are characterized by microscopic morphology. Photographs are being made under standard conditions of as many as possible of the different types of particles found in wind erosion products, industrial dusts, and combustion products for compilation in an atlas which will include the history of the end product. There are indications that various sources of smoke and fly ash can be unequivocally identified. The morphology of these particles is found to depend upon the type of fuel, equipment, and operation used in the combustion process. These methods can be used to obtain information on the percentage of smoke and fly ash contributed by

various sources, the geographic distribution of fly ash from a given industrial stack, the percentage of smoke and fly ash in total settled or suspended dust samples, and the operating efficiency of a given industrial stack.

One of the papers on meteorology, by Frederick E. Bartlett, Brookhaven National Laboratory, Upton, N.Y., described the use of oil fog and radioactive materials as tracers in long-range diffusion studies. These techniques have been developed for concentration measurements in a plume from a single source out to distances of 30 to 40 miles from the Brookhaven site. The sampling devices were mounted on a light aircraft which made passes through the plume, normal to the axis, at various elevations and distances from the source. The greatest practical problem in the experiments was the exact positioning of the aircraft in space when traversing the plume. During stable conditions the apparent diffusion of the plumes was less than that expected by the investigator.

*Health Aspects*

Reports of work on pulmonary physiology included the following particularly interesting papers.

Dr. Richard Ehrlich, Armour Research Foundation, Chicago, discussed the effects of atmospheric pollutants on susceptibility to respiratory infection. The specific pollutant used during the present phase of the investigation was ozone and the micro-organism causing the infection was Klebsiella pneumoniae. In the preliminary phase of the programme the virulence and viability studies of the organism were conducted to determine the $LD_{50}$ for mice. Experimental conditions included exposure of Swiss albino mice to ozone prior to the challenge with bacterial aerosol and aerosol challenge prior to ozone exposure. In every case the mortality was greater for mice previously exposed to ozone. An exact recovery time was not determined, but on one occasion a delay overnight before insulating with bacteria still caused an increase in mortality. Dr. Ehrlich speculated that ozone might have its activity embodied in an anesthetic action of the cilia.

Dr. Robert Frank, Harvard School of Public Health, Boston, Mass., reported on respiratory responses to sulphur dioxide in controlled human exposure. The effects of $SO_2$ alone and with an aerosol on the respiratory mechanics of healthy human subjects was measured by an esophageal catheter and a body plethysmograph. Thirteen subjects were exposed 26 times to concentrations of gas ranging from 1 to 20 ppm. During exposure to $SO_2$ alone, there was no change in pulmonary flow resistance at concentrations of 1 to 2 ppm, 19 per cent. increase (above control) from 4 to 5 ppm, while at 8 to 19 ppm it rose 49 per cent. The average response to aerosol plus $SO_2$ in concentrations of 8 to 20 ppm was 72 per cent.

The findings of Dr. Wright which follow are contrary to those of Dr. Frank. The discussion on the effect of $SO_2$ is given after Dr. Wright's paper.

Dr. George Wright, St. Luke's Hospital, Cleveland, Ohio, investigated the pulmonary reaction of normal and emphysematous persons to the irritations of $SO_2$ fly ash, and moisture. Eight normal men and four persons having diffuse obstructive emphysema were exposed for 20 to 25 minutes to $SO_2$ in concentrations ranging from 2·5 to 23 ppm, particulates less than 10 microns in size varying from 6 to 1·2 million particles per cubic foot, and water aerosol. Airway resistance, maximum and minimum midexpiratory flow rates, maximum breathing capacity, timed vital capacity, pulmonary volumina, and ventilation effectiveness were measured before and within 20 minutes after exposure. The normal subjects showed no trend as to resistance changes consequent to exposure. None of the variations following the exposure were greater than hour-to-hour or day-to-day variations of control, nonexposed persons.

Four men having classic clinical and physiologic evidences of diffuse obstructive emphysema were exposed for 20 minutes to 5 ppm $SO_2$, 6·0 million particles per cubic foot, and added water aerosol. Each individual demonstrated a decrease in the airway resistance, and no change in other measurements following the exposure. A vigorous discussion followed, as the results of Dr. Wright do not agree with those of Dr. Frank, who found an increase in airway resistance after exposure to $SO_2$. Dr. Patrick J. Lawther, St. Bartholomew's Hospital, London, stated that his findings indicated that, with the exception of the rare $SO_2$ sensitive individuals, the net effect of $SO_2$ exposure was a slightly beneficial loosening of mucus within the bronchial tree.

Dr. Frank stated that this was contrary to his findings; $SO_2$ above 5 ppm would produce a statistically significant change in airway resistance. Attempts by the group to explain this discrepancy brought out the fact that there was a slight lag time in Dr. Wright's measurement after exposure, while Dr. Frank's subjects were measured while breathing the gas. In addition, it was pointed out that Dr. Frank's subjects mouth-breathed, bypassing whatever protective action is supplied by the nasal passages, while Dr. Wright's subjects were free to nose-breathe, thereby possibly increasing the washout of $SO_2$.

Dr. Branscombe added to the discussion the fact that numerous intermittent exposures to 1 per cent. $SO_2$ from an aerosol bomb over a 40-minute period produced no change in respiratory loops on his testing equipment but caused cough and expectoration.

*Incineration*

Among a number of engineering papers was the report of Prof. E. R. Kaiser, senior research scientist, College of Engineering, New York University, New York City, on a variety of incinerator problems, which was read by James Halitsky. Work previously reported by N.Y.U. has shown how air pollution from flue-fed incinerators can be reduced by use of hopper locks on the flue, overfire air jets in the furnace, auxiliary gas firing, and flue-gas scrubbers. The use of barometric and orifice dampers in the flue is being evaluated since entrainment of particulate matter in flue gases can be markedly reduced by control of upward gas velocities during burning.

Plans are underway for research on incinerators for burning junked automobiles prior to the salvage of steel and other metals. A prototype suitable for burning 30 car bodies a day is to be built and tested. Smokelessness is to be achieved by an oil-fired afterburner.

*Fluorine and CO*

Two papers of particular interest dealing with environmental levels of pollutants were given by R. C. Specht and G. D. Clayton.

Randolph C. Specht, American Agricultural Chemical Co., Pierce, Fla., discussed the results of a study of the uptake of fluorides by grass grown on Florida soils which had been leached with water containing fluorides. It was demonstrated that soils have the ability to fix fluoride ions from fluoric acids and calcium fluoride either directly or as components of superphosphates. Grass grown on soil previously leached with water containing fluorides showed approximately the same fluoride content as grass grown on soil leached with distilled water.

George D. Clayton, of G. D. Clayton and Associates, Inc., Detroit, Mich., discussed the relationship of street level CO concentrations to traffic accidents. Three recording infra-red CO analyzers were set up at various locations in Detroit. One recorder was located for 27 weeks on a depressed highway within the city and showed CO readings ranging from 0 to 100 ppm with a median of approximately 8 ppm. Another recorder,

placed in a busy neighbourhood shopping area for 58 weeks, showed CO level ranging from 0 to 100 ppm, with a median of 10 ppm. For 21 weeks a third recorder was operated in downtown Detroit, with CO readings of from 0 to 100 ppm and a median of approximately 9 ppm. The CO in the atmosphere of a residential area was sampled during a period of 18 weeks. Concentrations of from 0 to 29 ppm were recorded, with a median of only 2 ppm. Data were correlated with such factors as traffic count and meteorological conditions. From these data attempts were made to predict under what conditions dangerous concentrations of carbon monoxide can be created in the atmosphere.

*Sulphur Dioxide*

On toxicology Dr. Robert M. Heyssel, Vanderbilt University, Nashville, Tenn., reported that groups of rats subjected to round-the-clock exposures of $SO_2$ gas at a series of levels from 1 to 32 ppm showed responses that increased with increasing concentrations. Although the study is not yet finished, it would appear from results thus far that continuous exposure to respiratory irritant $SO_2$ provokes more severe reaction in rats than an equivalent level intermittently. Whether the same exposure duration (concentration time value) intermittently will result in the same response as that from a continuous exposure of equal duration remains to be determined. The possibility of nutritional alteration of the rat diet from continuous $SO_2$ exposure should be considered in final appraisal of the results, a variable not as yet eliminated.

*Synergism*

A mechanism involving molecular physics designed to form the base of an understanding of the repeatedly reported synergistic properties of aerosols to intensify or attenuate the toxic or irritant effects of gases and vapours was proposed by Dr. Alexander Goetz, California Institute of Technology, Pasadena. The basic assumption of his theory of synergism is that an accumulation of the toxic gas molecules results from their partial or total adsorption on the surface of the particulates which in turn carry the gas in more concentrated form to the susceptible lung tissue. Whether this synergism acts in the intensifying or attenuating sense depends on whether this type of reaction between gas and particulate is such as to promote or prevent the transfer of the adsorbed gas molecules on to the tissue surface, subsequent to its contact with the particle. The theory is in good agreement with experimental results already obtained in animals. Moreover as predicted from theory (finite number of gaseous adsorption layers) the synergistic effect vanishes for high relative irritant concentrations and increases with increasing aerosol concentrations for low irritant levels.

*Automotive Exhausts*

On automotive exhaust research. Dr. W. L. Faith, Air Pollution Foundation, San Marino, California, reported proposed methods for the control of automotive exhaust emissions. Olefinic hydrocarbons, carbon monoxide, and polynuclear hydrocarbons have been indicated as pollutants requiring effective control. Due to the variability of the energy level (combustible concentrations) and oxygen level in the automotive exhaust gases, the most promising method of alleviation is afterburning of the contaminants. Three such systems are under development; direct flame afterburners with heat exchangers, direct flame afterburners with auxiliary fuel, and oxidation catalyst converters. The chief problems facing the developers at present are related to the equipment size, materials of construction, methods for combustion, air addition, maintenance, and replacement requirements and costs.

Dr. Patrick J. Lawther, Medical Research Council, Dunn Laboratories, St. Bartholomew's Hospital, London, discussed pollution of the atmosphere by carbon monoxide, oxides of nitrogen, smoke, and polycyclic hydrocarbons from automotive exhaust. This study emphasized the effect on the ambient air as measured in garage areas, low-level street areas, and vehicular tunnels. The garage area studies indicated that diesel buses contributed insignificant amounts of polycyclic hydrocarbons and the levels of carbon monoxide and oxides of nitrogen were well below maximum allowable concentrations. The tunnel studies, designed to evaluate the effect on the atmosphere of all types of vehicles under varying conditions of load and maintenance, indicated concentrations of polycyclic hydrocarbons equivalent to those found in the urban air in the winter months. Carbon monoxide concentrations measured at street level reached values as high as 350 ppm. Work with this latter contaminant will be continued.

On chemistry, Dr. Amos Turk, department of chemistry, City College, New York City, reported on studies of both fundamental and practical importance concerning sampling of vapours on activated carbon and on the recovery of materials so adsorbed. Of particular interest is his work on the impregnation of carbon with more or less specific reagent to remove certain chemicals which would not otherwise be collected as completely by the carbon. For example, he showed brominated charcoal to have a very high affinity for olefins, including ethylene; charcoal impregnated with sodium silicate will remove hydrogen fluoride with extremely high efficiency. Other factors mentioned were techniques for recovery of sorbed material, the removal of water from collected materials, and the nature of the so-called " carbon odour ".

Among the papers on community studies, which terminated the Seminar, was that of Dr. John J. Phair, University of Cincinnati, Cincinnati, Ohio, who reported on the design of epidemiological investigations of community air pollution. Dose, resistance, and response must be defined in reasonably exact terms in any epidemiological investigation of the health effects of air pollution. Data analysis must also make provision for adjustment of variation in degree and time in pollutant concentration. Epidemiological investigations do not replace but supplement the work being done in industrial plants, experimental laboratories and community surveys.

*West Germany*

# SULPHUR IN FUEL OIL

***From Werner Hansen, Essen***

A Bill is pending in Germany to require fuel oil to be desulphurized to a level comparable with coal on a calorific basis. It may be taken as a fact that high concentrations of sulphur oxides at ground level lead to damage to vegetation, to eye irritation, and that they may cause destruction of material, especially if moist soot which has adsorbed $SO_3$ comes into contact with metal or other surfaces. Damage is also caused by acidic droplets from condensed water droplets and $SO_3$.

These facts, and the proposed Bill have led to serious investigations on how to reduce the sulphur content of the fuel oil or to find ways to prevent the sulphur oxides being emitted from stacks.

So far no technical and at the same time economic way has been found to reduce the sulphur content of heavy fuel oil (3500 secs.). Efforts in this direc-

tion are not too popular as long as it is possible to produce or import low-sulphur fuel oils from low-sulphur crude oil—especially as these oils are reasonable in price.

There has been a trial run with a big scale plant to desulphurize heavy fuel oil from 3·5 to 1·5 per cent. sulphur. The process proved to be too costly and too complicated as it involved a continuous change of the catalyst chambers through the poisoning of the catalyst by sulphur.

Heavy fuel oil in Germany is at the present time available at a price of 70 to 90 DM per ton, free to consumers' tank, depending on the transport distance. The desulphurization of heavy fuel oil costs about 40 DM per ton if 2 per cent sulphur is eliminated. With this process the price per ton would be raised about 50 per cent. Low-sulphur oil from Russian sources, with a sulphur content of 0·4 per cent. costs only 15 to 20 DM per ton more than the heavy fuel oil which has a normal sulphur level of 2·5 to 3·5 per cent.

There is some uneasy feeling among consumers about the availability and price of low-sulphur fuel oil. Only a few areas in the world are at present able to produce low-sulphur crude oil, although the general tendency—not only in Western Europe—will be preferably to burn this. The reason, as well as clean air, is high and low temperature corrosion. This especially concerns industrial areas. Certain towns—as for instance, Moscow—already have legislation to require a change from coal or fuel oil to natural gas. This trend will certainly affect in the long run the present rather modest prices for low sulphur fuel oil.

Private initiative in Germany has led to certain other trials to eliminate sulphur by the removal of sulphur oxides in the flue gases. One way has proved to be successful. The flue gases pass into a special chamber with a catalyst at a temperature of about 350°C. The sulphur dioxides are adsorbed and the gases cleaned of any solid particles. The plant has proved to be rather costly: the cost of desulphurizing the flue gases per ton of fuel is low, but depends on the possibility of selling the recovered sulphur. After being cleaned the flue gases pass the further heating surfaces of the boiler. There is no temperature drop in the catalyst chamber as the reactions take place under exothermic conditions. Research is still under way. The firms taking an active part in the development of this process hope to be able in the future to burn any high-sulphur fuel oil at a net cost lower than that of any other oil with less than 2·5 per cent. sulphur.

A further process is attracting interest at present. The idea is to blow basic material into the combustion chamber—similar to dolomite injection. This material is mixed with a cheap catalyst which oxidizes $SO_2$ to $SO_3$. Under the temperature conditions of the combustion chamber the $SO_3$ at once reacts with the basic material to $SO_4$. The price of this process is low and the investment required is negligible. First estimates are a cost of not more than 5 DM per ton of fuel oil burned. These costs are easily borne as the absence of $SO_3$ would allow for far lower exit gas temperatures than are possible in modern boilers nowadays.

The German Coal Board is following these efforts with intense interest as they may lead to a reduction of coal consumption in the industrial areas, which for the most part are where coal is produced.

## M.A.C.'S FOR THREE POLLUTANTS

*From Dr. Helmut Kettner*

The Commission for Air Purification has recently established maximum allowable ground limit concentrations for three substances. For each are given two values, for long-term and for short-term concentrations. The long-term concentration can be exceeded by the short-term three times in one day. Following are the figures:

| Substance | Concentration p.p.m. Long Term | Short Term |
|---|---|---|
| Nitrogen oxides as $NO_2$ | 0·5 | 1·0 |
| Chlorine (Cl) .. .. | 0·1 | 0·5 |
| Hydrogen sulphide .. | 0·1 | 0·2 |

*Italy*

# POLLUTION NEAR VENICE

***From Professor B. Paccagnella, Ferrara***

A report has been issued on "Atmospheric Pollution of Mestre-Marghera (Venezia) by Paccagnella, B., and Fontanella, E. (Riv. It. Igiene, 1961, **21**, 25).

The urban and industrial development of Venice are actually occurring on the near mainland, in the area of Mestre (residential) and of Mort Marghera (industrial). Because of this expansion and the required town planning, preliminary investigations were carried out during 1953 on the characteristics and levels of air pollution in the territory.

The main problem was to define, as accurately as possible, the extent of the area affected by air contaminants, especially of industrial origin, in order to suggest suitable limits and directions to the urban building developments. These investigations were carried out by means of air samples collected at different points, representative of the territory being considered, and the analyses were concerned with defining the concentrations of $SO_2$, Fl, $NO_2$ and dusts.

Later, for a systematic investigation in the city of Padua the A.A. used the instruments and techniques based on British practice (a report on this investigation from 1955 to 1958 was presented to the International Clean Air Conference, London, 1959). With the same methodology they began, in 1956, a second investigation in the area of Mestre-Marghera, using four stations located respectively in the middle of the industrial area, the central and periperic residential areas, and the rural area.

The analytical data of the second investigation are not directly comparable with the data of the first, the methods being different. Nevertheless, the practical point of view they prove that the rural areas chosen for the future residential developments are already notably polluted by contaminants from the industrial area. The results are good enough to indicate more suitable directions for the future development of the new town.

*Piave Valley Cement Works.*—The A.A. have studied and reported on the characteristics and nature of pollution from a cement factory in the Piave River Valley, north Italy. (Fontanella, E., Magri, C., and Paccagnella, B., Igiene Moderna, 1960, **53**, 1-4, 67). It was found that the total discharge from the chimneys was about 100-120 tons per month of dust. In the area of neighbouring villages, using deposit gauges, 8 to 42 tons per sq. km. per month of total deposited matter was measured. This contains 8-11 per cent. of total silica and 3-5 per cent. of free silica.

No epidemiological investigations have been carried out on the population, but information collected is in agreement with general knowledge in the field: an absence of organic disease related to the heavy dust pollution, but important harm to amenities and economic damage.

*Australia*

# SYDNEY CONFERENCE, 1962

A Clean Air Conference, sponsored jointly by the New South Wales Department of Public Health and the University of New South Wales, will be held at the University on February 19th and 20th, 1962.

The advent of the Clean Air Bill, at present before the State Parliament,

has stimulated interest in prevention and control of air pollution. The major objects of the conference are to provide an initial opportunity for technical discussion of the problems of air pollution, and to supply information concerning the proposed legislation and its administration.

The first day's meetings will be on the general and administrative aspects of air pollution control, and on the second day there will be technical papers dealing with the evaluation and reduction of pollution.

Further information may be obtained from Dr. J. L. Sullivan, Chief Scientific Officer, Division of Occupational Health, Department of Public Health, who is acting as Conference Secretary. His address is 86 George Street North, Sydney.

*Japan*

## POLLUTION CONTROL IN PORT AREAS

A Report on " Development of Port Areas for Industry in Japan " has been issued by the International Co-operation Administration, Japan Productivity Centre. Concerned with all development, re-development and planning of industrial areas in or around seaports, the report emphasizes the importance of air pollution control. There is increasing public interest in air pollution and although control measures have been started " the work is immature and needs to be promoted to full scale." Reference is made to the special " Public Hazards " Department in Tokyo, and measures such as the expansion of " model area for prevention of smoke " (smokeless zones ?), the registration of smoke producing equipment and the initiation of loans for the improvement of equipment.

Outstanding current problems are discussed:

" For technical solution of air pollution, various measures are taken for fuel used, combustion and heating equipment and the related operations. Also, industries like iron and steel, cement and power generation are energetically promoting the installation of smoke dust collecting equipment. However, the installation of electrical or mechanical dust collectors is still a costly work and, besides, the performance of the equipment and the efficiency of its operation are not as yet at a satisfactory level. Particularly desired is highly efficient equipment for use by small manufacturing industries."

*South Africa*

## DURBAN'S CAMPAIGN

Mr. K. N. Johnson, Air Pollution Control Engineer, City of Durban, has sent us their campaign Newsletter (No. 2). Among other information is a map of the city's first two smokeless zones—for the central area and the beach front area. It is pointed out that these are the first smokeless zones in South Africa. Temporary exemptions are granted where extensive modifications or replacements are necessary, and to avoid financial hardship the Durban Corporation operates a Loan Scheme to cover the costs of any modifications or replacements. The interest rate is low and repayment is over a period of five years. Further aspects of the campaign referred to are prior approval requirements for new installations, advice and stoker demonstrations, training courses for stokers, and the action taken with respect to smoky vehicles, locomotives and shipping.

Durban is to be congratulated on what is clearly an all-round, concerted and continuing campaign for clean air.

*U.S.A.*

## A NEWS LETTER

***from Arthur C. Stern,***

*U.S. Public Health Service*

*Technical Meetings.*—The Annual Meeting of the Air Pollution Control Association was held in New York

City, June 11th-15th, 1961. The highlight of the meeting was the keynote address presented by the Under-Secretary of the United States Department of Health, Education, and Welfare, Mr. Ivan A. Nestingen. Since this paper discusses national policy in air pollution, a copy is being sent to you. [We hope to publish this address in full in our next issue.—*Ed.*]

Among other meetings of interest in June were the first Air Cleaning Institute held at Harvard University June 19th-22nd, and the first summer course in air pollution held at Syracuse University, June 19th-30th.

Among the more interesting technical meetings in the immediate future is the three-day seminar of Atmospheric Carcinogen Chemistry to be held at the Robert A. Taft Sanitary Engineering Centre of the United States Public Health Service by the Laboratory of Engineering and Physical Sciences, Division of Air Pollution.

2. *New Research Facility.*—As from June 1st, the Public Health Service acquired by long-term lease an additional Research facility in Cincinnati, Ohio, to be used as an annex to the Robert A. Taft Sanitary Engineering Centre. This five-year-old research and administration building contains about 35,000 sq. ft. of usable space. The laboratory facilities are being completely occupied by the Laboratory of Medical and Biological Sciences of the Division of Air Pollution, P.H.S., primarily for exposure of animals to experimentally produced air pollutants. The office facilities have been occupied by the Technical Assistance and Field Studies Branches of the Division of Air Pollution. As from 1st January, 1962, a Honeywell 400 electronic computer will be installed in this facility. The laboratories and activities of the Division of Air Pollution's Laboratory of Engineering and Physical Sciences remain at the main facility of the Sanitary Engineering Centre.

3. *California.*—Things are relatively quiescent on the California front. As of mid-July, the Motor Vehicle Pollution Control Board had received 22 applications from device manufacturers for exhaust control procedures or devices, six of which were still pending, one of which had been accepted for testing. The Board also received a report from its Executive Officer that one formal application had been received for a crankcase emission device, and that testing was proceeding on a second one for which no formal application had as yet been received.

## SURVEY OF RUSSIAN A.P. WORKS

The U.S. Department of Commerce, Office of Technical Services, announces that the 5th volume in a continuing survey of Russian literatures on air pollution and related occupational diseases, being conducted by Dr. Ben S. Levine under a U.S. Public Health Service Research Grant, is now available to science and industry through the Office of Technical Services, Business and Defence Administration, U.S. Department of Commerce, Washington 25, D.C. (Price $3.50. Earlier volumes $3 or $4).

Dr. Levine's latest survey of Soviet literature dealing with the air pollution aspects of industrial and public health problems contains translations of 45 articles in six sections dealing with: Russian studies of limits of allowable concentration; pharmacological, toxicological, and clinical data; industrial sanitation; ionization and ultra-violet radiation; benzpyrene; and analytical techniques for measuring various pollutants. In response to inquiries Dr. Levine has included in the introduction to this volume an analysis of Pavlovian physiology and its potential use in air pollution investigations.

## LEAD POLLUTION STUDIES

Intensive studies of lead levels—in the air and in the human system—have been launched, as from June 2nd

in Philadelphia, Los Angeles, and Cincinatti, the U.S. Public Health Service has announced.

These studies are the outgrowth of recommendations on tetraethyl lead made by a special advisory committee to the Surgeon General of the Public Health Service. The committee suggested that the Public Health Service, in collaboration with manufacturers of tetraethyl lead and other appropriate organizations, conduct studies to help develop hygienic standards for atmospheric lead and to learn more about the body burden of lead in various selected population groups.

Two types of studies will be made. First, the air over the three cities at several sites will be sampled and measured for the presence of lead contaminants. Second, medical studies will evaluate lead levels in the blood and urine of both average population groups and other groups whose work exposes them to heavy amounts of auto exhaust.

In addition, special studies may be made of carbon monoxide and airborne lead in such locations as garages and vehicular tunnels, where they are presumed to be more concentrated.

The community studies in Philadelphia and Los Angeles will be conducted by the Air Pollution Division of the Public Health Service in cooperation with the Philadelphia city and California State health departments. The Cincinnati study will be conducted by the Kettering Laboratory of the University of Cincinnati, supported by funds from Ethyl Corporation and E. I. duPont de Nemours & Company.

**Technical Report of California Standards for Ambient Air Quality and Motor Vehicle Exhaust.** State of California, Department of Public Health, 2151 Berkeley Way, Berkeley 4, California.

This technical report (pp. 136, 4to) is a detailed and pioneer effort to define the quality of air for California's communities by means of standards that have been developed and adopted. The standards also represent the first attempt to establish limits for the emission of pollutants from the exhaust of motor vehicles. The report falls into three sections: 1. The standards and their significance; 2. the technical bases for standards for the quality of ambient air; and 3, the technical bases for motor vehicle exhaust standards.

*France*

A paper given by M. Henri Perdon to the 1960 National Congress of the Association for the Prevention of Atmospheric Pollution, has been reprinted as a separate publication by the French Institute of Fuel and Energy.

M. Perdon stresses the importance of efficient combustion of fuel to combat atmospheric pollution, enumerates effective methods employed in France to achieve this and urges the need for further improvements in the future.

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**The British Non-Ferrous Metals Research Association Report**

The British Non-Ferrous Metals Research Association in its annual report for 1960, mentions the special problems which the Clean Air Act presents to firms manufacturing copper and aluminium alloys because the fineness of the particles released into the atmosphere defeats normal air washing equipment. The Association has organized a team of experts in the field experimenting at a dozen plants with existing types of equipment to advise on the most effective. This work is done in co-operation with the Chief Alkali Inspector of the Minister of Housing and Local Government, "who looks to the Association for assistance in formulating reasonable specific requirements in the same way as industry looks to the Association for help in meeting the demands made upon them."

# CONFERENCE RECORDS

We have received several new volumes of proceedings of recent conferences, all of which make an important contribution to a more or less specialized sector of air pollution studies.

The record of a recent (the date is not given) international symposium held at the University of California Medical Centre, San Francisco, has been published under the title of **The Air We Breathe** (Thomas, Springfield, Ill., and Blackwell Scientific Publications, Oxford, pp. 414, £5 12s. net). Edited by Seymour M. Farber, M.D., and Roger H. L. Wilson, M.D., of the University of California, it contains 25 papers divided into five main sections. These are the "normal" atmosphere and its variations; the air pollution problem of industry; urban living and air pollution, smog and fog; specific problems; and lung cancer.

The papers are for the most part of a strictly scientific nature, and although some are not of direct air pollution concern—as in the first section—the greater part of the volume is very much of interest. A panel discussion on "What can we do to make our cities more habitable" is a more informal interlude that contains many good points.

The British Occupational Hygiene Society held an international symposium in London in March, 1960, the proceedings of which have now been published as **Inhaled Particles and Vapours** (pp. 495, Pergamon Press, Oxford, £5 net). This is edited by C. N. Davies of the London School of Hygiene and Tropical Medicine, and it will be of interest to mention that the conference secretary was Peter P. C. Isaac, of King's College, University of Durham, a member of the Executive Council of the N.S.C.A.

This volume is even weightier than the Californian report noticed above, and it is equally difficult to give it an adequate review in limited space. There were 38 papers which are reprinted with the discussions upon them. The inhalation of foreign substances in the atmosphere had never been discussed on such a scale before, and the symposium was attended by over 200 scientists from many different countries.

Included in the book are papers on the mechanics of breathing, fine anatomy of the lung, deposition of particles in various parts of the lung, the uptake of vapours, the elimination and storage of various dusts in the lungs, phagocyte activity, causation of asbestodis and silicosis, dust sampling related to industrial health, and radioactive dusts.

In our winter, 1960, issue (No. 116) we published the Introductory Note contributed by Dr. R. Lessing to a General Discussion of the Faraday Society held at Bristol in September, 1960. **The Physical Chemistry of Aerosols** (pp. 228. Faraday Society, with their agents for publications, Aberdeen University Press, 50s. net) is the title of the proceedings now published. The volume includes Dr. Lessing's introduction and the 24 papers that were read and discussed. They are grouped under the sectional headings of nucleation, the growth of particles, and their physical and chemical properties. The papers are of course primarily for specialist study, and the report is an important contribution to the literatures on fundamental matters that affect among other things our understanding of the true nature and behaviour of atmospheric pollutants.

**Cyclones in Industry** (Elsevier, Amsterdam, and D. Van Nostrand, London, pp. 151, 53s. net) is the title of a collection of papers on the principles and utilization of industrial cyclones originally presented at two symposia on the subject organized in 1953 and 1958 by the Royal Dutch

Institute of Engineers and the Royal Netherlands Chemical Society.

This edition is in English, and it is pointed out that there are in the Netherlands a number of industries and consulting engineers engaged in the development of cyclones for many applications, and that their country has accordingly acquired an international reputation for experience in the field.

No book devoted exclusively to cyclones in industry has hitherto been published, and it is said that it " will fill a gap which has been a constant source of irritation to engineers throughout the world."

# *Recommendations*

### Chimney Heights, Instruments, Deposit Gauges

The Federation of British Industries has issued a handbook of recommendations on **Height and Design of New Chimneys** (pp. 15, F.B.I., London, 4s. net). This has been drawn up by a working party of technical experts (including two members of the NSCA Council, Dr. Colclough and Mr. G. Nonhebel). The main recommendations refer to industrial boiler plants with an output of 5,000 to 33,000 lb./hr. steam at maximum continuous rating. Recommendations are also made in respect of larger plants up to an aggregate steam capacity of 450,000 lb. hr.

The recommendations are grouped to cover general recommendations on chimney design applicable to all classes of plant, on the height of chimneys for small industrial boiler plants, and chimneys for large commercial buildings. Then follow recommendations for estimating chimney heights required to prevent any sulphur dioxide present in the flue gases from becoming harmful at ground level under ordinary weather conditions; and on control of grit and dust deposits by relating the height of a chimney to the amounts of grit and dust escaping a dust arrestor.

The recommendations are in line with those made by Nonhebel in his paper to the Institute of Fuel last year (see *Smokeless Air*, Summer and Autumn, 1960 issues) and the handbook is in effect a guide based on this paper in a short and handy form. Though primarily intended for industrialists it will be of considerable value to local authority officers dealing with chimney height approval, and it is commended to them.

Criticism is made of local authorities who have stated that they propose to approve the height of chimneys in terms of calculated maximum concentration of sulphur dioxide at ground-level resulting from the emission, basing this on the Sutton formula for cold gas quoted in Appendix VI of the Beaver Report. " It is," it is said " technically incorrect to use the Sutton formula without taking into account the height to which hot gases rise above the chimney top; the necessity for calculating this thermal rise does not appear to have been appreciated by the above-mentioned local authorities."

Industrialists, fuel technologists and local authority inspectors will also find useful a handbook on **Recommended Instrumentation for Small Boilers,** published by BIMCAM, which in full is the British Industrial Measuring and Control Apparatus Manufacturers' Association (pp. 24, 2s. post free). The handbook has been issued in collaboration with the National Industrial Fuel Efficiency Service.

It deals concisely with measurement instruments, gas analysis, smoke density measurement, the selection and siting of instruments, etc. Essential requirements and what are called " desirable " additions are summarized in a double page table of instruments

and the various categories of boilers.

Rather more definite than recommendations is the new **Specification for Deposit Gauges,** being Part 1 of Methods for the Measurement of Air Pollution, now issued by the British Standards Institution (B.S.1747: Pt. 1: 1961, 5s. net). This is a revision of the B.S.1747 of 1951, and apart from detail one of the main changes in the deposit gauge specification is the substitution of plastic material, such as polythene, in place of glass for the collecting bottle. It is, of course, much less liable to fracture.

## WARREN SPRING LABORATORY

**Report of the Warren Spring Laboratory, Department of Scientific and Industrial Research** (pp. 25, H.M.S.O., 3s. net).

Only a small part, though an important part, of the report deals with air pollution. It reviews the genesis and work being done on the National Survey, a fuller report on which is to be given at the NSCA Brighton Conference in October. Reference is made to the analysis of data that has shown that smoke concentration in a town are largely independent of its size—as discussed in a paper by F. P. Williams at the Harrogate Conference, 1960—and there is also a reference to the Hornsey investigation of road traffic pollution, reported elsewhere in this issue.

A section headed "Trends of Pollution" is a useful summary of information of importance, and may be quoted in full:

Analysis of the air pollution data obtained from local authorities and other co-operating organizations in the past few years has produced results of considerable national interest. From 1952 to 1959, for the country as a whole, the emission of smoke slowly but steadily decreased, it is estimated from 2·3 to 1·9 million tons per year. In the same period the emission of sulphur dioxide increased at about the same rate, from an estimated 4·9 to 5·5 million tons per year. Measured concentrations of smoke at ground level tended, on the average, to decrease. The greater part of the smoke pollution was due to low-level sources, domestic chimneys and the like, and the decrease in smoke emission is reflected in the decrease in smoke concentrations observed. A large proportion of the sulphur dioxide pollution arose from industry, with much of it emitted from higher chimneys. Despite the increase in emissions, however, there is no detectable trend in sulphur dioxide concentrations at low level, thereby showing that these higher chimneys make a smaller contribution to the pollution of the air in which men live and work than do lower chimneys.

The pollution figures for London are even more interesting in showing the improvements that can be effected by vigorous action on smoke abatement. From 1953 to 1959, the emission of smoke decreased from an estimated 152,000 tons to 82,000 tons per year and observed concentrations of smoke near ground level decreased correspondingly.

A list is given of papers published by the laboratory and its staff during the year, and it is pleasing to note that out of a total of 31, five were contributed to the Society's conferences or this journal.

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## B.I.S.R.A.

**B.I.S.R.A. Annual Report 1960**

In the Fluid Dynamics Section dealing with air pollution in this new report of the British Iron and Steel Research Association, it is reported that the Chief Alkali Inspector has now clearly expressed his opinion that all steelmaking processes making regular use of oxygen for refining, must be fitted with gas cleaning plant. Therefore in collaboration with the Air and River Pollution Committee of the British Iron and Steel Federation, the problems of collecting and cleaning the gases from electric-arc furnaces, converters and open-hearth furnaces are being assessed so that the best guidance can be given to the industry.

*CORRESPONDENCE*

# VERTICAL EXHAUSTS

*The Editor,*
*Smokeless Air*

Sir:

I am writing with reference to the copy of a letter from Mr. T. H. Turner which appeared in the Summer 1961 issue of *Smokeless Air*.

Although Mr. Turner argues a general case for the adoption of vertical exhaust pipes, it is evident that he has much in mind the nuisance caused by emission of heavy black smoke from a minority of diesel-engined vehicles. It cannot be too often emphasized that this situation can be avoided by proper maintenance of the engines and the ancillary fuel injection equipment.

Mr. Turner dismisses too lightly the very cogent objections to a vertical exhaust for double-deck buses. Both wind tunnel investigations and practical tests have shown that because of the nature of the air stream caused by the movement of the vehicle, the fumes exhausted at roof level would frequently be drawn inside the vehicle, this being particularly liable to take place in dense, slow moving traffic and during periods when the vehicle was stopped at traffic lights. Even were it technically possible to achieve absolutely complete combustion of the fuel, the exhaust products would still contain a significant proportion of carbon dioxide. This is quickly dispersed in free air but its concentration in the upper deck of a vehicle would be most objectionable. It has also to be remembered that another product of complete combustion is water. Some condensation in the tail-pipe of the exhaust is inevitable and with a vertical exhaust the trouble would be much accentuated. During acceleration after a period of idling, droplets of water would be expelled from the exhaust outlet and, in addition to upper deck passengers, pedestrians at ground level would have a legitimate reason for complaint.

A further point which should be borne in mind is that the exhaust products from internal combustion engines are heavier than air and the fumes emitted from a vertical exhaust would still tend to find their way to ground level. This can indeed be seen with diesel rail cars despite their use of vertical exhausts.

I have confined my remarks in the main to double-deck buses but the same arguments apply to single deck vehicles, whether passenger or goods, and to motor cars. With vertical exhausts it would be impossible to prevent the ingress of fumes into the vehicles, thereby causing a degree of discomfort to riders much greater than is met with by pedestrians in the open air. The only satisfactory way in which the nuisance of exhaust fumes can be minimized is by proper maintenance and good driving practice—requirements which apply to diesel-engined and petrol-driven vehicles alike.

Yours, etc.,
A. T. WILFORD

London.

*The Editor,*
*Smokeless Air*

Sir:

There seems no doubt, as Mr. Turner reminds us (*Smokeless Air*, Summer 1961), a real need for tackling the problem of pollution by motor vehicle exhausts but somehow, as far as the diesel engine is concerned, I am doubtful if the vertical exhaust is the real answer. Whether or not the diesel vehicle is the greatest offender in the pollution of the air by road vehicles at least it does produce much visible pollution and considerable objectionable smell, which can justly be said to be out of phase with "Clean Air" standards. However, as far as I know the main disadvantage with a vertical exhaust for diesels is that the products of combustion contain heavy matter which will in any case fall rapidly back to the ground. Only when a vehicle is to be operated on dusty or unmade

roads or tracks would there seem a direct advantage in the vertical exhaust. What engine designers seem to have forgotten is that with the ever increasing size of post war engines the volume of exhaust gases must likewise increase and the positioning of exhaust pipes becomes more critical.

The development of diesel deodorants is interesting and shows that the problem of the diesel exhaust is being tackled but it seems strange to me that interest has not been revived in the Erren engine, particularly in connection with hydrogen as a primer for diesel fuel. References I have to hand are the *Autocar*, July 1st, 1932, and November 25th, 1932, and the *Automobile Engineer*, July, 1942 (reprinted from 1937), which show amongst other interesting features how engines including one for a 32-seater bus have been converted to the Erren principle.

In respect to "Clean Air" the Erren engine is very interesting because the hydrogen is claimed to make considerable improvements in combustion characteristics and efficiencies with consequently cleaner exhausts. In the case of the hydrogen-air version the exhaust becomes little more than steam and nitrogen and with the hydrogen-oxygen cycle steam alone.

These reports were of the 1930s and no doubt there were difficulties to be overcome before engines of this type could be considered commercial propositions, otherwise we should have heard more about them by now. But today we have the technology of the 1960s and a stronger than ever motive for pursuing the "Clean Air" theme. Rightly or wrongly, diesel-engined motor buses come in for considerable criticism. They do of necessity congregate in crowded city streets so it would seem that clean exhausts for these vehicles is of even greater importance than for diesel-engined vehicles generally. Can it be hoped that some large municipal operator could become interested in the Erren engine?

Yours, etc.,

A. HALL

Liverpool.

[The Erren system referred to in the above letter was originally developed for the use of hydrogen as the fuel, with air, in a gas engine. With hydrogen injected under pressure from a storage cylinder, and a special combustion cycle, the effective compression could be raised well above that possible with a normally aspirated engine, increasing efficiency even at low loads. Hydrogen could also be used as a primer with liquid hydrocarbon fuels, and tests on a diesel engine show that power output was considerably increased, noise reduced, and a previously smoky exhaust changed to a faint haze. Coal gas instead of hydrogen could be used. It was suggested that in addition to road vehicles hydrogen injection could be used with advantage in diesel railway and mine locomotives. The system was apparently used in German submarines during the last war but does not appear to have been further developed.—*Ed.*]

## DIESELS IN COAL MINES

*The Editor,*
*Smokeless Air*

Sir:

In *Smokeless Air*, No. 188, page 279 I note that in the discussion on Mr Harrap's paper, Miss D. Boyd referred to a statement by Dr. Lawther that the only acceptable means of traction in coal mines was diesel engines. I write to point out that this is incorrect, as considerable use is made of electric traction in coal mines which is, of course, the only form of traction that does not eject harmful gases and solid particles (not always visible) and which is also the only form of traction which does not contribute to the shocking atmospheric pollution in our town and city streets.

Yours, etc.,

R. D. REYNOLDS

Twickenham, Middx.

### B.R.S. fined £5

A British Road Services lorry in Archway Road, Highgate, was seen to be discharging a stream of thick black smoke between 10 and 12 ft. long. The Highgate magistrates on July 10th fined the lorry driver, Herbert Evans, of Stroud Green Road, Finsbury Park, £2. British Road Services were fined £5.

# SMOKE CONTROL AREAS

## Progress Report

### POSITION TO JUNE 30th, 1961—TOTALS

| | England and Wales | Scotland |
|---|---|---|
| **Smokeless Zones** (Local Acts) in Operation . . Acres, 3,400 Premises, 41,060 | 44 | 1 |
| **Smoke Control Areas in Operation** . . . . Acres, 41,325 Premises, 265,229 | 297 | 12 |
| **Smoke Control Orders**— | | |
| Confirmed . . . . . | 256 | 7 |
| Submitted . . . . . | 125 | 7 |
| **Grand Totals** . . . . . | 722 | 27 |

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Summer, 1961), which give the position up to March 31st, 1961. They now show the changes and additions to June 30th, 1961.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

### ENGLAND AND WALES

#### New Smoke Control Areas in Operation

Aireborough U.D. No. 7, *Ashton-under-Lyne B. No. 1, *Bolton C.B. No. 3, *Bootle C.B. Nos. 1 and 2, *Chesterfield B. No. 1, *Connah's Quay U.D. No. 1, *Corby U.D. No. 1, Droylsden U.D. Nos. 3 to 7, Halifax C.B. No. 3, *Heywood B. No. 1, *Hyde B. No. 1, Leeds C.B. Nos. 4 and 5, Long Eaton U.D. No. 1, *Preston C.B. No. 2, *Scunthorpe B. No. 1, Smethwick C.B. No. 3, Southall B. No. 2, Southport C.B. No. 1, *Spenborough B. No. 1, Walthamstow B. No. 1.

#### New Orders Confirmed but not yet in Operation

Acton B. No. 4, Barnet U.D. No. 2, Barnsley C.B. No. 2, Battersea M.B, No. 2, *Billingham U.D. No. 1, Birmingham C.B. Nos. 7 to 9, *Bolton C.B. Nos. 6, 7 and 9 to 14, Bootle C.B. No. 3, *Bradford C.B. No. 2, *Bristol C.B. No. 6, Bromley B. No. 3, Cheadle and Gatley U.D. No. 1, Cheshunt U.D. No. 1, Crayford U.D. No. 1, *Dartford B. No. 1, Dewsbury C.B. No. 3, Ealing B. No. 5, Eccles B. No. 1B, Ellesmere Port B. No. 4, Feltham U.D. No. 1, Gateshead C.B. No. 3, Hackney M.B. No. 3, Halesowen B. No. 3, Halifax C.B. No. 5, Hampstead M.B. No. 3, Holborn M.B. No. 4, Hornsey B. No. 3, Islington M.B. Nos. 3 and 4, *Leek U.D. No. 1, Leicester C.B. No. 6, Lewisham M.B. No. 8, *Liverpool C.B. Nos. 10 to 12, Manchester C.B. No. 3, *Newcastle-under-Lyme B. No. 1, Newcastle-upon Tyne C.B. No. 3, Oldbury B. No. 1, *Oldham C.B. Nos. 1 and 2, Prescot U.D. No. 1, Radcliffe B. No. 1, Reading C.B. Nos. 3, 6 and 7, Richmond (Surrey) B. No. 2, *Sheffield C.B. No. 2, *Shrewsbury B. No. 1, Slough B. No. 1, Southampton C.B. No. 1, Southwark M.B. No. 1, Stalybridge B. No. 5, Stepney M.B. No. 2, Stockport C.B. No. 3, Sunderland C.B. Nos. 2 and 4, Thornaby-on-Tees B. No. 1, Wallasey C.B. No. 6, Willesden B. No. 3,

Wolverhampton C.B. No. 1, Woolwich M.B. No. 11, Worsley U.D. No. 2, Yiewsley and West Drayton U.D. No. 2.

**New Orders Submitted for Confirmation but not yet Confirmed**

Altrincham B. Nos. 4 and 5, Ashton-under-Lyme B. No. 14, Beddington & Wallington B. No. 2, Bolton C.B. Nos. 16 to 18, Camberwell M.B. No. 2, Colne B. No. 1, Denton U.D. No. 5, Derby C.B. No. 1, Dudley C.B. No. 4, Ealing B. No. 7, Finsbury M.B. No. 1, Greenwich M.B. No. 2, Hayes and Harlington U.D. Nos. 16 and 17, Heston and Isleworth B. No. 3, High Wycombe B. No. 10, Huddersfield C.B. Nos. 3 & 4, Islington M.B. Nos. 3 and 4, Leigh B. No. 1, Leyton B. No. 2, Manchester C.B. No. 4, Merton and Morden U.D. No. 1, Morley B. Nos. 8, 9, 11 and 12, Nuneaton B. No. 5, Oldham C.B. No. 3, Oxford C.B. No. 3, Poplar M.B. Nos. 7 to 13, Preston C.B. No. 5, Prestwich B. No. 4, Queensbury and Shelf U.D. No. 1, Rochdale C.B. No. 4, Sedgley U.D. Nos. 3 to 6, Smethwick C.B. No. 4, Southgate B. No. 2, Spenborough B. No. 2, Stalybridge B. No. 1, Stockport C.B. No. 4, Stratford B. No. 2, Twickenham B. No. 1, Wakefield C.B. No. 2, Wallsend B. No. 1, Walthamstow B. No. 2, Wednesbury B. No. 1, West Bromwich C.B. Nos. 7 and 9, Westhoughton U.D. No. 1, Westminster M.B. No. 6, Wigan C.B. No. 1, Woolwich M.B. Nos. 9 and 12.

### SCOTLAND

**New Smoke Control Areas in Operation**

Dundee (Glamis Road), Lanark County (Westwood, East Kilbride).

**New Orders Confirmed but not yet in Operation**

Edinburgh (Centre of City No. 2).

**New Orders Submitted for Confirmation but not yet Confirmed**

Edinburgh (Sighthill No. 4).

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# AIR POLLUTION AND BRONCHITIS

The **Report of the Medical Research Council, 1959-1960** (pp. 326, H.M.S.O., 15s. 6d. net) includes among its reviews of selected subjects an article on The Causation of Chronic Bronchitis. It points out that the recorded mortality rate from bronchitis in the United Kingdom is much higher than in any other country, and in middle-aged and elderly men is as much as 40 times greater than that reported in Scandinavia and the United States. At least 25,000 deaths are attributed to bronchitis each year, and the mortality rate, unlike that for pneumonia or tuberculosis, has not declined in the past 20 years with the general use of antibiotics. From an economic standpoint, says the article, bronchitis presents an equally serious problem; approximately 10 per cent. of all periods of absence from work are certified as due to bronchitis, which thus results in a total annual loss of over 25 million working days.

The epidemiological studies that have been undertaken, including those on the relation between air pollution and bronchitis, are reviewed, and it is concluded:

"*So far it has been impossible to discern any effect of atmospheric pollution on the earliest stage of bronchitis, largely because of the difficulty of distinguishing persons thus affected. But the effect of acute changes in atmospheric pollution upon the health of those with existing chest diseases has been abundantly demonstrated, even though the mechanism remains obscure.*"

And as a final conclusion to the article as a whole:

"*While much further research is needed, it is already clear that cigarette smoking and air pollution are two important factors in the causation of the disease. There is little doubt that effective measures taken against these hazards could prevent much of the ill-health, suffering, and premature mortality which chronic bronchitis at present inflicts on the population of the country.*"

# *Parallel Paths*

## How Opposition to Clean Air Repeats the Pattern of that to the Great 19th Century Health Reforms

JUST over a hundred years ago, when our great grandparents were born, the industrial cities and towns of England were, for ordinary men and women, little short of a living hell. Southwood Smith, physician to the London Fever Hospital, said in his evidence to the State of Towns Commission that a foreign friend visiting a town commented on the cleanliness, neatness and apparent healthfulness of the main streets, not knowing of the crowded and filthy condition in the courts and yards where most people lived. A complete lack of sanitary arrangements, so that refuse—human and vegetable—piled up in the streets, grossly inefficient drainage, burial grounds which were so densely packed with bodies that to avoid obscenity was impossible—this was the physical background of life. Add to it houses built as cheaply as possible, often with no foundations and with earthen floors, drinking water contaminated by seepage of human ordure or putrefying matter from a graveyard, and skies overcast with "that Hellish and dismal cloud of Sea-Coale" and the picture is complete. That this is not an exaggeration is shown by an examination of contemporary records. Chadwick gives a glimpse of the hazards of social inquiry at that time (1843) in a letter to the Registrar-General. He had spent his vacation visiting the courts and yards of towns in company with Lyon Playfair, Sir Henry de la Beche, and James Smith the land drainage expert. Smith contracted dysentery. Lyon Playfair became seriously ill, and Sir Henry was so overcome by the foul smells and evil sights that he had to give up. These then were the normal conditions of life for "the humbler classes," the background to the pleas of Kingsley and Scott Holland for "social justice," causing the cry of Ebenezer Elliott, "Let them not pass like weeds away, Their heritage a sunless day!"

Many housewives in industrial towns struggled hard to maintain reasonable standards of cleanliness, "the floors of their houses and their steps washed clean, when the first persons coming in must spoil their labours by filth from the street, their clothes washed and hung out to dry, but befouled by soot from the neighbouring furnaces." Many were not equal to the struggle.

Why were such conditions allowed to continue? The reasons are exactly the same as those which, in our own day, have hampered the advance of smoke control—ignorance, apathy, opposition from vested interests, misrepresentation and a set of priorities in which "keeping down the rates" ranks higher than essential human welfare. In fact, the arguments used against the introduction of piped water and adequate sewage disposal methods are so close to those used to counter the introduction of smoke control, that one feels that time has stood still. "The people won't stand for it!" "To the knowledge of the oldest inhabitant, the town is remarkable for the health of the inhabitants." "An infringement of liberty." "Ratepayers do hate spending money." "The people will resist such a proposal," and so we might go on.

### No Need for Reform

Ignorance of the connection between dirt and disease was widespread. Even the wealthy lived in splendid squalor. Mansions in Belgravia reeked from the exhalations of defective drains, and Playfair's report on Buckingham Palace was so bad that

the Government did not dare publish it. There was ignorance too, in technical matters. The Metropolitan Commission of Sewers advertised for a Surveyor, the sole qualification specified as essential being the ability to use a spirit level. Much of the ignorance of social conditions was undoubtedly due to a form of " social blindness." Clerk to the Tower Hamlets Division declared in 1838 that he knew of no fever cases in his area. A notorious fever nest—Baker's Arms Alley—was only a few yards from his office! Many Members of Parliament, against overwhelming evidence, refused to recognize descriptions of their own towns. The Member for Stafford could not believe that the town was unhealthy, although a petition had been signed by all the doctors, all the clergy of different denominations, the late mayor, and a majority of the aldermen and town council. It was reported that £100,000 had recently been spent on improvements in Exeter, and the place had never been healthier—but Lord Ebrington had only just returned from a meeting at Exeter, under the chairmanship of the mayor, at which strong complaints were made about the sanitary state of the town and the lack of pure water. The Medical Superintendent of Arkwright's Mill at Cromford was " not aware of excessive mortality amongst the poor," although he was responsible for the supervision of hundreds of workers. At Bromyard, Herefordshire, considerable opposition to the application of the Public Health Act to the town was reported. " Many of the inhabitants were quite incredulous with regard to the fact of the town being in that unhealthy and neglected state in which I found it. Strange to say, amongst these I found some who had lost wives or children by epidemic or endemic diseases, and from whose houses fever was seldom long absent."

Today, a prominent miners' Trade Union leader says that he " cannot accept the implications . . . that the coal fire is the major source of atmospheric pollution . . . the evidence so far available does not support these implications." " London is a clean city. A white shirt can be worn for a week in London, and still be clean," said a member of a Health Executive Council recently. At Leamington a worthy Alderman said that the smoke control campaign was " a most stupid mistake." The " real culprits " were two or three large chimneys—not the thousands of domestic chimneys. If the Alderman climbs out of the Leam valley, perhaps to the Campion Hills, on a still day in the autumn, he will see Leamington lying enveloped in a cloud of domestic smoke. (In 1850, the Inspector of the General Board of Health complimented the Leamington Corporation on their obvious interest in good sanitation and clean water, and remarked on their ready co-operation. " We have no smoke problem here," said the Council of a well-known residential town in the south of England. Their opinion changed when they saw an aerial photograph. There were many occasions when ordinary men and women were genuinely unaware of the advantages of newer methods of sewage disposal, or of using disinfectants. In one case this resulted in a somewhat humorous turn of events. A newly appointed Medical Officer at Southampton was afraid of a serious outbreak of cholera in 1866. He insisted that badly blocked sewers were opened, cleared, and flushed with



**London Night Men**

carbolic acid. The labourers refused to use the disinfectant until they were forced to, and nicknamed it " diabolic acid "! On many other occasions, there was the strongest opposition to the use of quicklime in vaults and cemeteries, even when the ground was utterly foul. Looking through some recent " Letters to the Editor " one finds that " Browned Off," " Buttercup Joe," " Freedom Fighter," and other correspondents seem to be quite unaware that " clean air " has any advantages at all. This lack of awareness is widespread: " Although I have flown day after day over towns in the Midlands, seeing little of them but their canopies of smoke, I find that more incredible than the smoke is the complete indifference of their inhabitants to the injury inflicted on them by its presence," wrote Captain A. G. Buckham, F.R.P.S., a few years ago.

**Interference with Liberty**

The Englishman is rightly jealous of his liberty, but in order to have freedom to live we must have freedom from that which causes illness and death. This is not always appreciated, and " the liberty of the subject " has always been a convenient weapon to use against social reform. " The powers of a Medical Officer of Health would be far too vague and arbitrary, and would be considered an infringement of the liberty of the subject, intolerable in a free country," Chadwick was told when he publicized the idea. (Contrary to general opinion, Chadwick was not the first person to make such a proposal. It was first proposed in 1838 by Farr and Rumsey). Chadwick was told that to insist on speedy burial after death, on the removal of the body to a " place of reception " was " an unwarranted interference with individual liberty." At Basingstoke, Stafford, and many other places, this was the excuse for opposition to public health reform. In the nineteen sixties 68,000 people die annually of bronchitis, 29,000 of them caused largely by air pollution. We waste over £400 million pounds worth of our national resources each year, and from Preston we hear that a council applying the Clean Air Act is composed of " synthetic dictators," and " dictating progressionists," that " thousands of householders and ratepayers . . . are determined to resist the intrusion of the privacy of their homes." The confirmation of the Smoke Control Order " is just dictatorship "—according to a local councillor. So were many Orders of the General Board of Health over 100 years ago, compelling the introduction of a continuous supply of pure water, and adequate sanitation. Many local councils have been abused like this. In Hinckley, Manchester, Bristol, Wythenshawe, Sheffield, and many other places, a vocal minority shrieks loudly of " dictatorship."—Clean water? Sewage disposal? Town drainage? Or smoke control?

**Patterns of Argument**

Anyone with any experience of public meetings knows, to his sorrow, when his opponents are unable to refute his arguments by an appeal to reason, they can easily seek to render his work of no avail by using one of three methods:

(1) Skilfully misrepresent his arguments, using emotional adjectives.

(2) Attack part of his argument, stating that nothing can be done about certain aspects of a problem, and arguing that therefore no action at all should be taken. (Obviously a first cousin of the logicians *bête noire*—" the fallacy of the undistributed middle "!)

(3) Attack the character and integrity of the speaker, imputing dark and unworthy motives.

The first of these tricks was well known to Socrates and the ancient writer of the Book of Job. Chadwick, Shaftesbury and many another public health worker has suffered from it, and it has been used to oppose schools, sanitation and smoke control. It only



**The Dust Heaps, Somers Town, in 1836**

needs the right mixture of adjectives . . . " hard-earned money dissipated . . . nebulous projects . . . boasted democracy . . . gigantic . . . hypocrisy and bluff . . . smoke control—abortive fantasy . . . oppressive measure " and the victory is half won. Of this kind of unreasoning argument, some of the best examples the writer has seen come from Preston. In 1849, however, the prominent citizens of Preston wanted facts. Men like Veevers and Myres, the Improvements Commissioners, Ascroft a local solicitor, S. C. Fisher, and especially the Reverend J. Clay, the Vicar, had taken immense trouble to find out the real condition of Preston, and what remedies should be applied. Clay had prepared his own report on public health in the town, had worked with the " Preston Charitable Society " to inspect many of the back courts, and argued from a sound basis of knowledge that although the existing system was " cheap," the people were the losers, financially. George Clarke, the Inspector, pointed out that although Preston was not *quite* as bad as some other places—the Council had provided public avenues and fields, and even a scavenging system—in the back courts and alleys where the greater part of the population lived, drainage was imperfect, the accumulation of animal and vegetable refuse considerable, and sanitary arrangements either primitive or non-existent.

In the 19th century, a tax was payable on windows, and one argument often met by the public health reformer was: " Why sewer our town, while an unjust tax prevents us from having enough air and light?" In other words—" We can't get rid of all the trouble, so why bother about part of it? "

In the nineteen sixties, a councillor from High Wycombe tells us that we should not do anything about domestic smoke because, he says (inaccurately) factories are untouched. A councillor at Walton-le-Dale, " Buttercup Joe " at Bristol, and " J.M." from Deane

cannot see why we should worry about coal smoke when lorries and cars still emit smoke and fumes. Other people say: " You can't get rid of sulphur fumes, so why worry about the smoke?" (This argument is often exaggerated, to suggest that sulphur is present in coke but not in coal, and that the fumes are therefore more " deadly "). Apart altogether from the fact that the emission of smoke from factories is strictly controlled, and that the driver of a smoking vehicle can be prosecuted, the fallacy in the argument is obvious—" You can't get rid of all the trouble, so why bother about part of it?"

" Mud-slinging " has been a tool—a despicable tool—used in argument for thousands of years. " Jobs for the boys "; " the Chief Public Health Inspector misled us by using clever films "; " the Society has exploited and exaggerated every circumstance . . . presenting facts and figures . . . in such a manner . . . as would scare the public." (This latter opinion of the Society differs somewhat from that of men who are better informed). However . . . " I acknowledge my obligations to Mr. Ronald Redman, relieving officer, who accompanied me . . . and bore with exemplary patience the insults with which he was assailed by some badly disposed persons . . . who, not content with reviling an honest and zealous public officer, did not spare myself in their coarse and insulting allusions." Who, where and when? The superintending Inspector writing in May, 1850, of Accrington.

**The Vested Interests**

In the sixties of both centuries there has been opposition from " vested interests "—water companies (with their " fighting fund "), gas companies, funeral clubs, some ratepayers and landlords in the 19th century; coal merchants (with *their* " fighting fund "!) some ratepayers and landlords in the 20th century. A hundred years ago the local authority in a town would send a petition to the Board of Health, asking that an Inspector visit them; and counter-petitions and deputations were common—and what petitions! At Macclesfield, for example, several of the signatures were not those of the persons they purported to be, several lived outside the area, and in some cases after the signature of the father those of his children were added. Many bona-fide ratepayers signed only because they were assured that it was a petition to reduce taxation. This activity was supplemented by public meetings, called by placards of an exaggerated character, and misleading handbills. A prominent opponent of reform said that at these meetings, only six people were in favour of the implementation of the Act. In fact, at the first meeting the voting was nearly equal, and at the second, held in the open air, a show of hands was taken after dark! Last year, coal merchants or their representatives went round a Northern town appealing for signatures to a petition against smoke control. Several signatories lived outside the area, and a fifteen-year-old boy (whose parents wanted a smoke control area) was induced to sign. The petition was supported by the usual misleading handbills, and press publicity. A petition at Huyton said to be supported by hundreds of residents actually contained 88 signatures, written in pencil and carefully inked over afterwards.

**Putting up the Rates**

Another close parallel is that between ratepayers' attitudes in the two centuries. Quite obviously no one wants to pay more rates or taxes than he need, but this does not justify a " hold-the-rates-down-at-all-costs " attitude. Of Bodmin in 1850, George Clarke wrote: " Bodmin may be said to be without sewerage. The town brook is receptacle for all the filth of the place "; but a special petition presented to the Clerk and the Town Council asserted that the application of the Public Health Act " would throw on the inhabitants expenses previously borne by the Corporation, that it would prove a serious tax to the

Borough and be injurious to its trade, and that the condition of the borough is not such as to need the provisions of the Act." From towns as far apart as Melcombe Regis and Accrington, Watford, Halifax and Bromyard came a similar cry: "We cannot afford to care for the health of the people. It will put up the rates!" Yet Chadwick at a national level and the Inspectors locally had shown that the economic losses were appalling. The cost of funerals in London totalled between £600,000 and £700,000 a year. Sickness meant loss of productive capacity, loss of profit, and loss of wages. The value of property was lowered by the disgusting conditions surrounding it. One Inspector after another speaks of those "who do not possess foresight sufficient to see that economic reforms will augment the value of their property, and who are generally opposed to any attempt to obtain better conditions." Surely, in 1960, people are sensible enough to recognize the communal good—or are they? Not "Clean Nonsense" of Sheffield, who complains of "enormous amounts of labour and material . . . increased rates and rateable values"; nor our friend at Preston who talks of "another increase in the rates . . . incurred in an abortive fantasy," nor "Rate-peg" of Manchester who says: "Surely our rates are not in a position to stand this heavy burden of conversion." From High Wycombe some petitioners declare that as a result of a smoke control order, there will be "considerable expense on the rates," and as this area is almost entirely one of owner occupied houses, many ratepayers object most strongly to such a burden." And this against the background of our neglect—£400 million wasted annually, deaths from bronchitis, and lung cancer. Public *health* is public *wealth.*

In order to confound a general argument, it is always helpful to be able to produce an example (even if the only one) to demonstrate the argument's "weakness." Wrote Chadwick in his report on Interments in Towns (1843): "Men with shrunken figures, and a peculiar cadaverous aspect have attended to give evidence of the healthfulness of their occupation of gravedigger." At Halifax, Squire Balme had made no personal inspection of the thirty dwellings he owned, but had infallible proof as to the good state of the health of the town: "He had a tenant 90 years of age who had resided for 60 years in one of the most confined and old-fashioned houses he possessed." Those who discuss public health matters in public frequently come across this argument. There is the man in the front of the hall suffering from chronic bronchitis, who objects to the removal of the smoke which has maimed him, and the lady at the back whose "aunty is eighty-five if she's a day, and never known a day's illness, in spite of living in a smoky town!"

**The Need for Information**

What is the reason for the obvious lack of awareness of the need for smoke control? One important reason is that, in all too many cases, the flow of ideas and information from the local authority to residents and ratepayers, and vice-versa, is lamentably inadequate. It is still just as true today as it was in 1866 that to ratepayers, "a good must be not only obvious, but acknowledged as such by them." How can citizens of a liberal democracy make up their minds unless they be informed? It is vital that the local authority use every possible channel for communicating to residents in its area the dangers arising from the use of raw coal on old-fashioned grates. The local press will usually take articles; local organizations—Round Table, Rotarians, Townswomen's Guilds, Ratepayers' Associations, church fellowships, etc.—usually welcome speakers on local topics; local exhibitions and film shows can be organized; leaflets can be distributed to householders, and posters exhibited in shopping centres. (The Society's Publicity Advisory Service will gladly advise on any branch of publicity—a free service for members—*Ed.*)

During the 19th century, before the first Public Health Act was applied to a town, public discussion of local conditions resulted in a petition signed by at least one-tenth of the ratepayers, to be sent to the General Board of Health. The Board sent an Inspector, whose visit was widely publicized, and who held at least one, usually four or five, public meetings, at which the reasons for the petition were explained, the needs of the town examined, and the views of the inhabitants ascertained. The inspector then went round the town, examining each road, court and alley. Everyone knew what was happening. Informed opinion is still the only sure foundation for sound government, and the vast complexity of modern life does not exempt any local authority from the task of laying a foundation of knowledge well in advance of the introduction of a smoke control order. About 1860, Sir John Simon wrote: " The consumption of smoke in private houses is unfortunately a matter to which hitherto little attention has been given. . . . A time will undoubtedly arrive . . . when chimneys will cease to convey to the atmosphere their present immense freight of fuel that has not been burnt and of heat that has not been utilized; . . . and our successors will wonder at the ludicrous ingenuity with which we have so long managed to diffuse our caloric and waste our coal in the directions where they least conduce to the purposes of comfort and utility." Surely, the time *has* now arrived?—*L.N.*

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# *New N.C.B. Films*

The National Coal Board has released two new films that will be of interest to many readers. On the technical side there is " Mechanical Firing of Coal." It is in colour and is in six separate sections, including an " Introduction " and a " Tailpiece " which it is preferable to include in any screening. In between there are sections on the different types of stoker—chain grate, coking, underfeed, and gravity feed.

At a recent preview the chain grate stoker section was shown, and it can be warmly recommended for the



*Scene from " Mechanical Firing of Coal "—the Laundry Manageress discusses the new installation*



*From the dream sequence in " Arthur Clears the Air "*

information it gives, its clarity and good photography. It would be suitable and instructive for showing to meetings of industrialists, boiler operators, technical students, and public health inspectors. Running time for the complete film is 60 minutes.

The second film shown " Arthur Clears the Air " is very different. Also in colour, running for 27 minutes, it is intended for showing where smoke control areas are to be established. It is a comedy about the problems of conversions, with Joan as a long-suffering wife whose husband Arthur is a determined do-it-yourself enthusiast. Despite the fun and fantasy (in a dream sequence) essential information and advice about procedure, fuels and appliances is deftly slipped in. There is a Public Health Inspector who is helpful, courteous and handsome, and in the wife's Cinderella-like dream he appears as Prince Charming, superbly dressed in 18th century attire—a transformation which may or may not enthral the members of his profession when they see the film. The acting is excellent, and although the dream fantasy may go on a little too long for some tastes, it helps to bring in all the smokeless fuels and their zoological mascots. The film should be most helpful as part of a local authority's smoke control campaign.

Both films are available on loan, and inquiries should be made to the Film Department, National Coal Board, Hobart House, London, S.W.1.

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**Insufficient proof for Black Smoke Summons**

When dangerous emission of smoke from a motor vehicle was alleged it seemed unfair to put the onus of proof on a police officer, unsupported by corroborative evidence, a solicitor, Mr. H. Waite, told Rotherham magistrates.

He was defending Brian Green, a lorry driver, of Little London Road, Sheffield, and his employers, the Wheeler Road Transport Co. Ltd., of Albert Road, Sheffield, who denied using a lorry which emitted smoke " likely to cause danger " and which had defective tyres.

A policeman said the lorry was blowing out a " cloud of black, dense smoke," and other vehicles were unable to overtake. In one of the rear tyres was a hole which had worn through three layers of canvas.

Mr. Waite said: " It would be much more satisfactory if police officers in cases like this were—in addition to stopping the defendant—to stop one of the following vehicles to get corroborative evidence."

The magistrates dismissed both summonses.

# THE 1960 ALKALI &c. WORKS REPORT

## *Fewer Complaints*

**The 97th Annual Report on Alkali, etc. Works, by the Chief Inspectors, 1960. pp. 68. H.M.S.O. 4s. net.**

THE extension because of the Clean Air Act of the responsibilities of the Alkali Inspectorate is reflected in the wide coverage of the new report, which is today one of the most important annual documents on air pollution to be published in this country. The original alkali works section occupies little more than one page, and there are some forty other processes or groups of processes given headlines. A substantial part of industry's air pollution problems are thus reviewed, and a great deal of valuable material about the present situation, developments and trends to be found in these pages—which, even more than in the past, cry out loud for a contents list or subject index for the aid of the reader who is looking for specific information.

Substantially fewer complaints required investigation in 1960 than in 1959 states the Chief Inspector for England and Wales, Dr. J. S. Carter. During 1960 specific complaints concerning 292 works were investigated, mainly at the request of local authorities. This compared with 354 complaints in 1959 and 133 in 1957. Complaints were most numerous against ceramic works (47), gas and coke works and iron and steel works (33 each), electricity works (32), aluminium works (14) and cement works (11).

The inspectorate's task is to ensure that air pollution from a great variety of industrial processes is reduced to a minimum. Until 1958 they were mainly concerned with processes in the heavy chemical and allied industries; but in 1958 the scope of the Alkali Act was greatly extended to include many other operations (for example, iron and steel manufacture and electricity production), where control of smoke, grit and dust presented problems of special technical difficulty. Generally speaking, processes have been brought under the Act where emissions are particularly dangerous or offensive, or for technical reasons and where there is a particular difficulty of control.

Beginning with the present report, some of the older processes registered under the Act are being selected for historical and technical review. The report deals with alkali, cement and tar works in this way, and there is also a review of alkali waste tips.

### Cement Works

The report notes that over 12 million tons of cement were produced in 1960 and that over the years the problem has changed from one of smoke and smell to that of dust emission. It traces the development of the cement making process to the introduction of the modern rotary kiln which has put an end to smoke and smell, but has resulted in the problem of dust-laden gases leaving the kiln. "The treatment of these dust-laden gases is one of the least tractable of the many problems facing the inspectorate," says the report. With new kilns or new works the problem can be minimized by suitable location of chimney, electric dust precipitator and kiln. The main problem is with existing kilns and chimney arrangements, in which long flues are unavoidable. Condensation is an ever-present hazard in such works and precipitators need constant attention and maintenance. "We have there-

fore required electrical precipitation at older works only in cases of real major complaint such as Thames-side," says the report. Other cases have been met by the installation of high-duty cyclone arrestors which the inspectorate believe will be adequate for medium-sized and certainly for small works.

There is also a low-level dust problem from grinding, conveying and packing of the cement itself, and the report says: " There is really no excuse for bad low-level conditions and inspectors have made this clear. Most works are fully co-operative here but on at least one occasion in 1960 strong representation, which seems to be having the desired effect, had to be made."

**Tar Works**

As a result of concentration in the tar industry the number of registrations under the Act has fallen from 341 in 1930 to 107 by the end of 1960. The report traces the development of the various processes and products of the industry, and points out that as from December 31st, 1956, when smoke became a listed noxious or offensive gas under the Clean Air Act, the tar industry, " which then included a certain number of offenders, was required to adopt the best practicable means to reduce smoke emission to the minimum."

" The co-operation has been good," says the report. " Complete success has not yet been attained although great progress has been made, especially with larger installations and works. The offenders are usually the small units and special stills. There is no cause for dissatisfaction at the rate of progress. Conditions as regards smoke emission in the industry are vastly improved and further progress is confidently expected."

Noting that some processes are new to the inspectorate, *e.g.* the new technique of impregnation of fibre pipes and certain routes for production of carbon, the report says that these are " pressing problems to which we have no immediate permanent and complete solution, although temporary measures are being applied."

**Alkali Works**

Alkali works operating the " salt-cake " process were responsible for the original Alkali Act of 1863, but today only 11 works are registered, and the great bulk of production is by mechanically operated, smokelessly fired units. The report says " plants have operated in a reasonably satisfactory manner." It notes only one infraction of the Act concerning an escape to air of hydrogen chloride.

The inspectorate have statutory powers of control (registration is not involved) over alkali waste heaps which at one time caused problems through the discharge of waste acid products into streams and were a source of evil smells.

The report says " alkali waste heaps, although still calling for attention, are not now a public health hazard. . . ." It adds, " If waste of any kind can be used for land levelling, road construction, etc., it should be."

**Power Stations**

The inspectorate's main pre-occupation has been with the medium-sized power stations, in which the main task is to ensure that the grit arrestment plant is maintained in an efficient state. " There is a difficult and major task ahead here for some years to come," says the report. Power stations burnt over one million tons more oil in 1960 than in 1959, and this method of fuelling gives rise to the problem of acid smuts. " Despite intensive study a complete and general remedy applicable to all power stations is not yet in sight," says the report.

The new stations of 1,000 MW and over are beginning to come into operation and the inspectorate's forward discussions with the Central Electricity Generating Board now refer to even larger units, of up to 2,000 MW, some of which may well be duplicated so as to become 4,000 MW stations. " High

efficiency grit arrestment will be essential," says the report, " and chimneys must be in the 600 ft. region or above."

**Iron and Steel**

In a review of the iron and steel industry the report states that although some problems still prove intractable, by and large the major decisions have been taken. " Industry and the inspectorate are agreed," says the report, " on the broad lines of the measures to be taken to deal with the great task in front of us. The cost will be recorded in millions of pounds and man hours; none the less there are grounds for sober confidence that the next two years will see remarkable progress. A sound and satisfactory start has already been made."

**A.E.A. Visits**

As in previous years, visits were made to several establishments of the Atomic Energy Authority to confirm that the Authority continue to use the best practicable means for reducing the emission of radioactive gases, mists and dusts, and to ensure that such discharges are regulated so that public health is not in any way endangered.

**Cat and Fish Smells**

Previous reports have given prominence to the problem of " cat " and " fish " smells in the Tees-side area. The cat smell has been eliminated by chlorination of the effluent before it enters the river. The fish smell has been dealt with as far as possible by fitting arrestment plant and by tightening up the supervision and maintenance of the production process which caused it, but the nature of the process is such that immunity from future outbreaks of short duration cannot be guaranteed.

## SCOTLAND

The number of registered premises in Scotland fell from 325 at the beginning of 1960 to 311 at the end of the year. The decrease was mainly attributable to the closure of gas works, but the number of processes requiring inspection increased, largely as a result of adjustments in the certificates of registration considered necessary after inspection of works, first registered in 1959, *e.g.* paper works which, on further consideration nearly all appeared registrable as chlorine works as well as for the process and recovery of caustic soda. The total number of visits made to premises registered under the Act was 465.

The iron and steel industry presented the most problems for solution. " In the cold print of a report," says the Chief Inspector for Scotland (Dr. E. A. Balfour Birse), " progress may not seem so impressive as it is in fact. Again the scale on which fume treatment has to be undertaken is not always easy to appreciate and the results may be overshadowed by other discharges of long standing. Fume treatment for an open hearth furnace may be in the order of £100,000. The expensive treatment at smaller furnaces such as are used in the steel foundry industry, will be less but still substantial. The overall cost to the iron and steel industry seems likely to be several million pounds, spread over a period of years. It is greatly to the credit of the industry that this onerous task is being faced with determination and goodwill."

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**Middlesbrough.** — Many local authorities have prepared and published their own clean air booklets, but we would like to congratulate Middlesbrough on the one they have just produced. It is not only well and clearly written, practical and to the point, but the type and layout is unusually good and the cover design is remarkably successful in conveying the idea of clean air.

* * *

According to a correspondent in the *Financial Times* diesel engines in vehicles are to be completely prohibited in the Lebanon in the near future.

# COAL INJECTION INTO BLAST FURNACES

Lord Robens, Chairman of the National Coal Board, referred to plans for the injection of coal into blast furnaces at the annual dinner of the Society of Chemical Industry at Keble College on July 12th, 1961.

Substantial economies in the use of coke for the manufacture of pig iron have already been achieved by the iron and steel industry in the past ten years.

" We in the coal industry," said Lord Robens, " must assist our industrial customers to achieve the higher efficiencies that new techniques make possible. An example of this is in the arrangements we have now concluded for the experimental injection of milled coal into blast furnaces. This will be a further step in the iron and steel industry's drive to reduce costs and increase productivity. The coal injected will fulfil the function of the coke it replaces by providing heat and gases for the production of iron ore."

" At least 30 per cent. of the coke used in furnaces could eventually be replaced when the technique has been fully proved," said Lord Robens. " In addition, as the coal injected is cheaper than the coke which will be replaced, considerations of fuel costs alone will make coal injection an attractive proposition. More than that, the substantial increases in blast furnace throughput, made possible by coal injection, provides an added financial incentive when increased output of iron is needed."

" In the new process the coal is injected automatically into the furnace through lances placed usually in the blast furnace tuyeres. The amount of coal injected is accurately controlled at a rate which can be adjusted to suit furnace conditions."

The technique was quite new to this country, said Lord Robens. The process was to be tried towards the end of this year at the works of the Stanton Ironworks Company Limited, near Nottingham. The injection equipment was being specially designed by Petrocarb Incorporated, the American firm which recently pioneered the full scale application of the coal injection technique in the United States.

The British Iron and Steel Research Association were taking an active part in the work and would be participating in the trials.

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# Conference on Grit and Dust Control

The Combustion Engineering Association announces a one-day conference on methods of controlling and measuring grit and dust, the equipment available and the cost of installation and maintenance. This will be at Leeds on Thursday, October 19th, in the Queens Hall at the Northern Exhibition of Fuel and Power for Industry.

The opening address will be by N. A. McNeill, President of the C.E.A. and Engineer-in-Chief, Unilever Ltd. He will be followed by a paper on the measurement of pollution and equipment for prevention to be given by Dr. R. Jackson of the British Coal Utilization Research Association. An afternoon session will be devoted to a paper on discussion on N.I.F.E.S. 7th Progress survey.

The C.E.A. are also arranging a display of coal and ash-handling equipment at the Railway Goods Yard, Salford, on September 19th to 21st, showing stokers and ash extractors, elevators and conveyors, mechanical shovels and grabs, and coal bagging plant. This is an important subject which sometimes has an air pollution component in the dust nuisance that can be caused. An attractive illustrated brochure " Coal Handling from Store to Boiler " has been produced by the Association in conjunction with other organizations.

Copies may be obtained and further details about the events mentioned may be obtained from the Association at 70 Jermyn St., London, S.W.1.

# NEWS FROM THE DIVISIONS

**Scottish**

The Division held a successful and well-attended two-day conference at North Berwick on May 18th and 19th. After the annual business meeting on the Thursday morning a paper was read on " The Measurement of Air Pollution and Interpretation of Results," by W. D. Slimming, Officer-in-Charge, Warren Spring Laboratory, Scotland. The address was of much interest in itself, but the interest was greatly increased by the way in which it was read by Mr. Slimming. The other papers, on the Friday morning, were a most practical and informative group from Glasgow. Collectively entitled " Smoke Control in Action," they dealt with the organization and administration involved in establishing smoke control areas in the city, with examination of the problems that had arisen. The legal aspects were dealt with by R. D. Brogan, Solicitor, of the Town Clerk's Department, the general aspects, survey work, fuels questions, etc., by Dr. W. A. Horne, Medical Officer of Health, and the financial side by James F. Gay, Accountant, of the City Chamberlain's office.

On the Thursday afternoon the members of the conference were the guests of the North Berwick Town Council on a most enjoyable visit to Lennoxlove House, a well-known historic mansion near Haddington, now the home of the Duke of Hamilton. The conference ended on the Friday with the customary lunch to the Provost and delegates, as guests of the Division. Mr. John Innes, who chaired the meetings, was re-elected President of the Division and Mr. Norman Fraser was re-elected Hon. Secretary.

**Yorkshire**

The Division met at the Ferrybridge Power Station on May 8th, and after a meeting of the Council in the morning a tour of inspection of this modern station was made. Ferrybridge " B " is a station of 300 mw capacity. Approximately 20,000 tons of low-grade fuel are pulverized and fired weekly. The three boilers have a guaranteed efficiency of 87 per cent. and the flue gases pass to one reinforced concrete chimney which is 425 feet high. The boilers are



*The West Midlands Division at Belper, reported in our last issue*



**Cleanglo Stockpile**—*photographed during the S.E. Division's visit to St. Albans Gas Works*

equipped with modern mechanical and electrostatic dust collectors which have a guaranteed overall collection efficiency of 99 per cent.

On May 16th, the Council of the Division held a joint meeting with the Executive Committee of the West Riding Clean Air Advisory Council at the showrooms of the Coal Utilization Council in Leeds for the purpose of inspecting and discussing a number of appliances and methods for igniting coke fires. Two new electric firelighters were on display and later the members were given a demonstration by Dr. Underwood of Sheffield University of his prototype "Para-fan" firelighter. Other appliances on view were a "Kwik-Fire" para-poker, a Calor gas poker, and a "Zip" chemical firelighter.

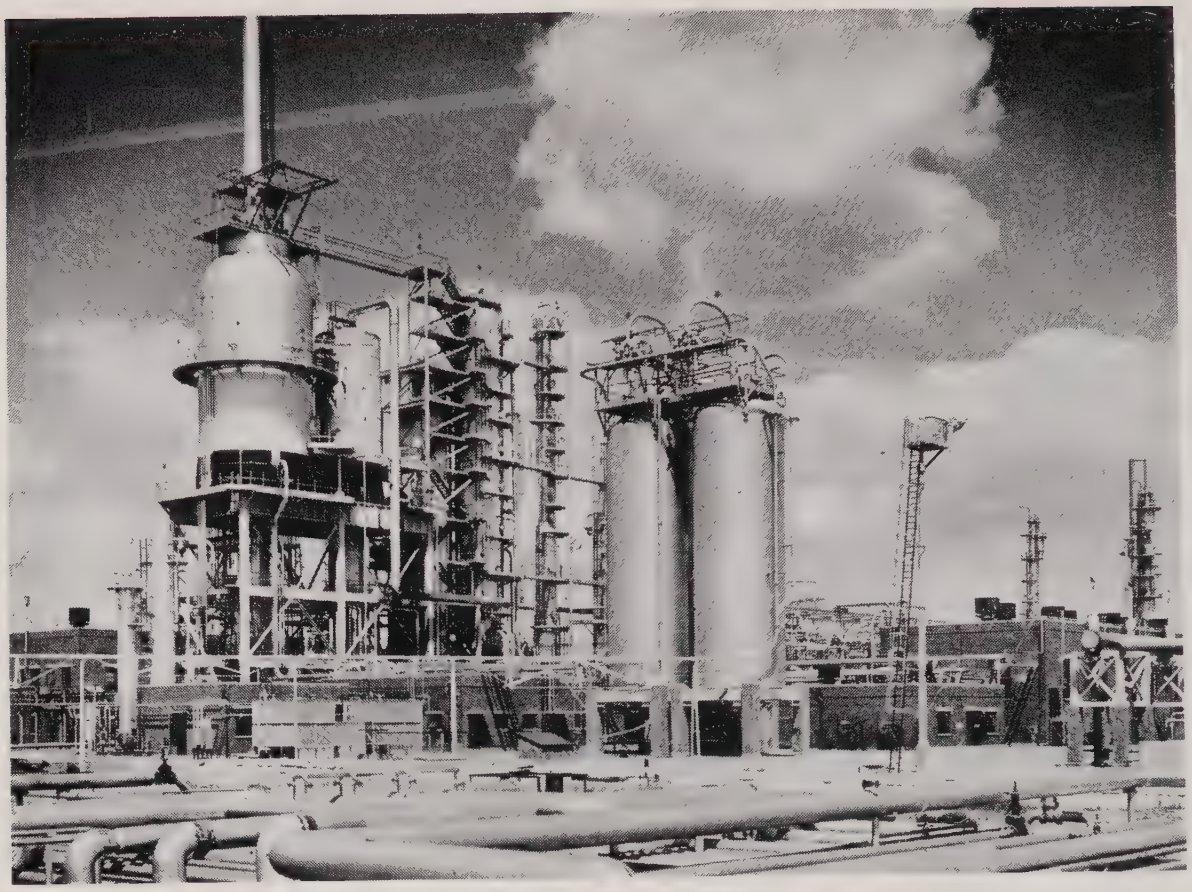
On July 10th the Division met in Sheffield, when a paper was read on "The Changing Pattern of Fuel Usage, with special reference to Smoke Control Areas," by J. E. Cooper, Technical Officer (Utilization) of the East Midlands Gas Board. It is hoped to give a fuller report of this paper in in our next issue.

**South East**

The Division held its Annual General Meeting on June 9th in London. The results of the annual postal elections of Officers and Council were announced. Alderman C. H. Smith, O.B.E., D.L., who had been Chairman for a number of years, and Mr. Norman Bastable (Barking) who had been Deputy Chairman, had both been nominated for the chairmanship. The results of the ballot were 55 votes for Mr. Bastable and 47 for Alderman Smith. On behalf of the members Alderman Smith was warmly thanked



*South East Members at St. Albans*



*The Catalytic Cracker Unit at the B.P. Kent Refinery*

by Dr. Lessing for his services to the Division. Mr. W. Combey (Oxford) was elected Deputy Chairman, and Mr. J. J. Matthews, Hon. Secretary.

The Division has held a series of visits during the summer, including one to the Kent oil refinery of British Petroleum Ltd., the modern gasworks at St. Albans, where the manufacture of Cleanglo—and its stock-piling—was seen, the Research Station of B.P. Ltd. at Sunbury-on-Thames, and the British Railways motive power depot at Stratford.

**East Midlands**

The Division met at Norwich on July 6th, holding its annual general meeting in the Council Chamber, City Hall, after a civic welcome from the Lord Mayor, who expressed his interest in the work of the Society. Mr. G. Drabble was elected Chairman for the year 1961-62, and Councillor

(*Concluded on page 62*)



*Inspecting the Hoskinson Smokeless Incinerator at Norwich*

# THE COAL REPORT

**National Coal Board: Report and Accounts for 1960,** H.M.S.O., 4s. net

During 1960 the Board's main objectives were to bring coal production below the level of demand without undue hardship to the mining community and at the same time increasing the efficiency of the industry. Consumption exceeded production by 9 million tons and stocks held by the Board fell by 6·5 million tons. Forty-four pits were closed or merged with others but all but 250 men displaced found other work by the beginning of 1961.

The Board's operating profit for the year was £20·2 million, and after paying £41·5 million interest and allowing for income from investments, there was a deficiency for the year of £21·3 million. Collieries made an operating profit of £15·6 million or 1s. 8d. a ton. Average cost of production was 84s. 5d. a ton, 2s. a ton more than in 1959. Opencast operating profits were £2·3 million against £3·9 million in 1959. The Board's coke ovens made an operating loss of 4s. 7d. a ton of coke against 9s. 10d. in 1959. The Board's non-operational expenditure amounted to £70·3 million in 1960 compared with £70·9 million in 1959. The salaries and related costs of non-operational staff amounted to 2¾d. a ton of coal produced.

Capital expenditure in 1960 amounted to £85·7 million compared with £112 million in 1959. Following the reconstruction plan for the industry thirty-three major projects were completed. Work proceeded on 103 reconstructions of existing pits and on 13 new collieries, three of which were brought into production. Mechanization of coal winning and loading was greatly extended. £4·8 million was expended on research.

### Marketing

The inland consumption of coal amounted to 196·9 million tons—7·3 million tons more than in 1959—of which 51·1 million tons was consumed at power stations, 22·3 million tons at gasworks, 28·5 million tons at cokeovens and 28·2 million tons in the domestic market. Gasworks made more gas from oil, took more gas from refineries, and took an increased amount of methane from coal mines. As a result gasworks consumption of coal fell by 200,000 tons.

### Carbonization

During the year the Board's coke ovens produced 5,842,000 tons of coke of which 1,738,000 tons (636,000 tons more than in 1959) went to blast furnaces, 980,000 tons (121,000 tons more) went to foundries, 2,109,000 tons (138,000 tons more) to other consumers and 451,000 tons (104,000 tons more) to export. Four of the older coke ovens were closed and output of coke was reduced as far as gas commitments permitted, and stocks of coke at the end of the year amounted to 5,089,000 tons.

### Manufactured fuels

The Board sold 714,000 tons of Phurnacite and intends to extend the Aberaman plant capacity from 650,000 tons to over 800,000 tons by the end of 1961, " Warmco," a reactive smokeless fuel for open fires, has been produced experimentally at Grassmoor until that plant was closed down, and is now being produced at Hardwick. Household demand for pitch-bound briquettes continued to decline and two plants supplying this market were closed down.

The Board continued research into the production of premium smokeless fuels. In one process high volatile coal is converted into char by carbonization in a fluid bed, and the char is briquetted hot. In a second, pitch-bound briquettes are made from a



*From the N.C.B. Report—the Hem Heath Colliery near Stoke-on-Trent*

blend of anthracite duff and low volatile coals. A process for making from anthracite duff a briquetted smokeless fuel for domestic central heating was also investigated.

**" Housewarming plan "**

The Board's loan scheme for the installation of solid fuel central heating directed to householders and small business premises has been well supported.

The British Coal Utilization Research Association has continued research into long-burning appliances that will not emit smoke. The miniature chain-grate stoker has had successful trials in London flats.

The Board's 63 brickworks produced 501 million bricks, compared with 485 million in 1959, at the rate of 9·3 manhours per thousand bricks. Profits amounted to £725,400 compared with £427,500 in 1959.

At the end of the year 480 coal preparation plants were in use.

Eighty-nine employees qualified for Boiler Operators' Certificate and 76 higher City and Guilds Certificates were obtained.—*A. J. C.*

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**Divisional News**—*concluded*

M. Hewitt, Deputy Chairman. Mr. A. Wade was re-elected Hon. Secretary and Mr. H. N. Eardley, Hon. Auditor. After the business meeting the paper by J. H. Smellie, which is reported in full in this issue, was read. There was considerable discussion and many questions.

Prior to the meeting members had visited the works of Andrews Heels Ltd., where a modern steam-raising plant, burning wood waste and installed by Meldrum Flood Page Ltd., was inspected and demonstrated. A visit was also paid to the Sunshine Bread Co. Ltd., where a demonstration was given of a Hoskinson smokeless incinerator.

## ADVISORY SERVICE ON SMUTS FROM OIL-FIRED BOILERS

During the last few years a considerable amount of research has been done to investigate the formation and subsequent agglomeration of carbonaceous and other material which is emitted, in the form of acid smuts, from the chimneys of some oil-fired industrial boiler plant. Application of the results of this research can, for the most part, prevent the emission of smuts.

The Warren Spring Laboratory of the Department of Scientific and Industrial Research has therefore set up an advisory panel, which will include representatives of the oil and burner industries, the C.E.G.B. and the N.I.F.E.S., to help Local Authorities and owners of plant to deal with the more difficult cases.

Where smut emission arises the first approach should be made to the oil supplier. Most oil companies have adequate facilities for dealing with such cases. Only if the trouble persists, or the oil company concerned is unable to assist, should the Warren Spring Advisory Panel be consulted. Enquiries to the Panel should be addressed to the Director, Warren Spring Laboratory, Gunnels Wood Road, Stevenage, Herts.

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### Glasgow Public Inquiry

Unless Glasgow went ahead with its plans for smoke control areas, there would be no future for many people in the city, the Medical Officer of Health, Dr. William A. Horne, told a public inquiry which ended on July 31st. "We must start soon if we are going to make an impression on chronic bronchitis and other ailments," he added.

Dr. Horne said he did not think it advisable to wait two or three years until a cheap smokeless fuel could be manufactured in Scotland, before going ahead with the clean air scheme.

"I don't see why so many people should be left to die or suffer," he said.

The inquiry into Glasgow Corporation's Pollokshields No. 2 Smoke Control Area Order, 1960, was heard by Mr. Ian MacDonald, Q.C., for the Secretary of State for Scotland.

Dr. Maurice Miller, convener of the Corporation Sub-Committee on Sanitary Services, said it would cost about £222,670 to adapt and replace all the fittings in the area concerned—the Western half of Pollokshields.

Mr. Stanley Moffat, solicitor, representing the Glasgow and District Coal Merchants' Association, who objected to the order, described the cost as "staggering," but Dr. Miller told him: "I think it is justified."

Mr. Archibald Jackson, managing director of J. & J. Vernal, coal and fuel merchants, Pollokshaws, said his objection was that coal merchants would lose customers to the electricity and gas boards.

Mr. MacDonald will report to the Secretary of State for Scotland.

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## *HEADQUARTERS FUND*

The following donations, received since the list published in our Spring 1961 issue, are acknowledged with thanks:

**10 guineas.**—Wallasey Corporation; Ipswich Corporation.
**£7.**—Hendon Corporation.
**4 guineas.**—Dudley Corporation.
**3 guineas.**—Eccles Corporation; Bristol and West Clean Air Committee.
**2½ guineas.**—York Corporation; Darton U.D.C.; Dronfield U.D.C.
**2 guineas.**—Hayes & Harlington U.D.C.; Rushden U.D.C.; Huyton-with-Roby U.D.C.; Altrincham Corporation.
**1½ guineas.**—Wellingborough U.D.C.

Total to date: **£4,416 1s. 6d.**

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### Exhaust Control

New York State Air Pollution Control Board is studying a plan for making exhaust purifying equipment mandatory on all cars. It is a device which returns to the engine cylinders partially burned gases from the crankcase.

# THE UTILIZATION OF WASTE MATERIALS FOR HEAT PRODUCTION

by

**J. H. Smellie, M.R.S.H., M.A.P.H.I.,**

*Chief Public Health Inspector, City of Norwich*

ALL combustible refuse has calorific value and if practicable it should be used as a fuel. This is more easily said than done, for, unfortunately, there is a number of factors which combine to make such practice difficult. The plant should be designed specifically for the purpose of burning waste, and may prove very expensive to build. Waste is a by-product and supplies may vary as may also the demands for steam. Waste materials used as fuels may be light in weight and bulky, with a low calorific value and these factors tend to make control of combustion difficult to attain. The products arising from combustion, or incomplete combustion, as the case may be, in the form of grit and smoke, are likely to be more concentrated than is the case with standard fuels, such as coke or coal, giving cause for complaint and contravening the provisions of the Clean Air Act. Nevertheless, in spite of these difficulties, I feel that more industrial waste will be utilized for heat production in the future.

Let us look at this subject in its right perspective, by making a brief survey of the history and practice of waste burning. I think I must confine my remarks to practices in this country since they are our main concern, and I should think the commonest waste fuel is wood. In the past many attempts have been made to burn wood waste on standard boilers but with disappointing results and I would like to suggest two reasons why this is so:

(1) The normal fire door has proved inadequate for feeding wood waste with vertical and locomotive types of boilers.

(2) Lancashire and Economic boilers even after modification and redesigning still give unsatisfactory results, the maximum efficiency having been sacrificed for fear of producing smoke and emitting burnt particles.

Treatment of waste matter varies considerably according to the bulk density of the material to be burned and one long established practice is worthy of consideration. I refer to the dutch oven, step grate furnace, or combustion chamber type of installation which takes the form of a brick lined chamber, in front of, or under, the boiler. The very nature of wood waste explains the reason for this type of furnace chamber. (See Fig. 1).

Wood is a variable fuel so far as heating value is concerned. Its calorific value varies according to the moisture and resin content and may range from 4,000-8,000 B.Th.U's per lb. The moisture content may range from 10-50 per cent. but in air dried wood is usually 10-15 per cent. It is easy to ignite and has a pleasant burning quality, and is a bulky material, a common mixture occupying approximately 100 cu. ft. per ton. When heated the volatiles distil off quite readily, and if smoke is to be prevented and perfect combustion realized, oxygen must be supplied in sufficient quantities. Other contributing factors are temperature (it must be sufficient to maintain combustion), time (which must be sufficient to allow combustion to take place), and turbulence (which will permit intimate mixing of air and

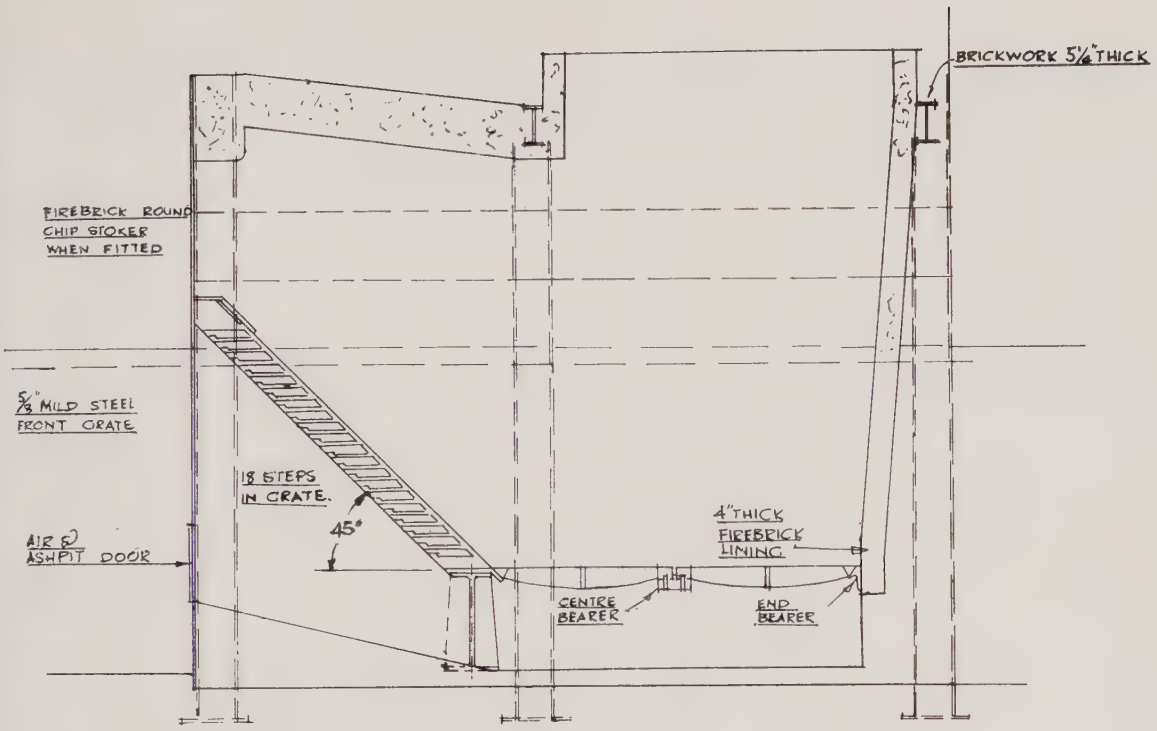



**Figure 1**

volatile matter). The furnace space should be sufficient to prevent flame impingement, which in turn leads to smoke production.

From what has already been said, one thing is evident, that the designing of a really satisfactory furnace is anything but simple. G. F. Rider (Process Plant) Ltd. argue that the conventional step grate is most unsatisfactory, and they give sound reasons. They contend that it is quite impossible to ensure that the step grate is evenly covered and therefore it is equally impossible to distinguish between primary and secondary air. To a lesser extent the same applies to any grate which fills the whole base area of the furnace to which it is fitted. Bearing in mind the high volatile content and low ash content of wood, the proportion of secondary air to primary air is more than in the case of less volatile fuels.

Overheating and damage to grates might occur owing to the wider spacing of normal fire bars, by the fire falling into the ashpit, emitting sufficient heat to destroy fire bars. A study of these factors has produced a grate, sufficiently fine to hold the waste, whatever its size, and having an area much less than the base of the furnace through which the air passes in the form of " needle jets." These jets impose a measurable resistance and thereby even out the distribution of air over the grate causing it to penetrate into the carbonaceous residue left after the volatiles have been distilled. The restricted grate area in conjunction with the perforated grate prevents heaps of mechanically fed chips forming near to the feed opening, thus cutting off primary air and allowing only combustion by secondary draught. The ideal setting for primary air is one which allows just sufficient material to accumulate on the bars to protect them from radiation from the furnace crown.

It must be ensured that the operating temperature of the furnace is sufficiently high to allow for combustion of the wood fuel. It is possible to generate very high temperatures provided the amount of excess air is kept to a minimum. A reasonable margin must be allowed to cover the rapidly changing combustion rates, inevitable with such a fuel, and a reasonably safe maximum can be maintained (1,200°C)

providing the moisture content is computed accurately. It is not a difficult matter to decide how much excess air is required to ensure that the furnace temperature is kept to within reasonable limits.

Successful furnace design must provide the means whereby combustion is complete before the products of combustion come into contact with the water-cooled surfaces of the boiler. When burnt in bulk, wood produces a long flame. Advantages are, therefore, to be gained in introducing an "after combustion chamber" or, rather, "the completion of combustion chamber." Experience tends to show that temperatures in this after combustion chamber may be appreciably higher than on the actual furnace grate. Modern wood waste furnaces should be fired throughout the 24 hours of a day, it being desirable to keep brickwork at an even temperature, thus preventing damage to the furnace brickwork.

Where total waste is less than steam demand, or where breaks in the fuel supply occur, industry has shown an understandable interest in the possibilities of combining the use of oil with a wood burning installation.

### Types of Installation in successful operation

(1) Where oil is complementary to wood waste and burns simultaneously in the same combustion chamber. One version of this is of necessity confined to chips and dust, mechanically-fired, and would not be capable of burning hand-fired offcuts, owing to the absence of a grate and the inability to open the furnace door whilst the burner is in operation. Fig. 2 shows the means adopted to permit the removal of ash from such a furnace, which is completely brick lined.

(2) Where wood waste and oil are alternative fuels to be burnt at different times. There are obvious advantages here in siting the burner in the after-combustion chamber or in a separate compartment divided off

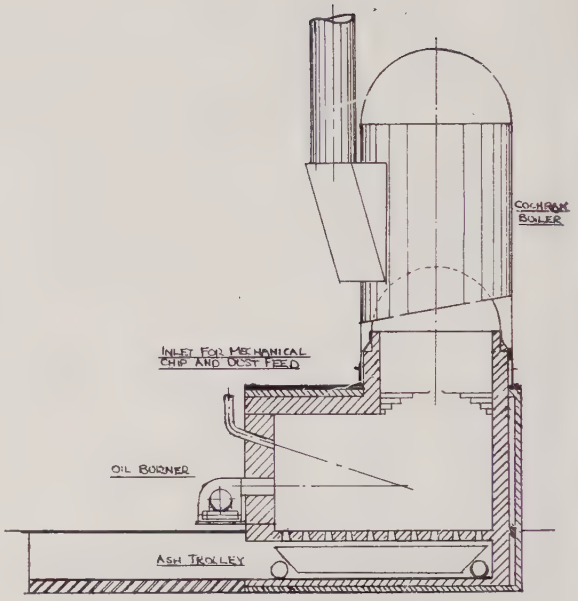



**Figure 2**

by a baffle wall, where the radiant heat of the oil flame can be exposed to the fire box of the boiler. To prevent fouling or over-heating by the products of combustion of the wood waste, the burner must be retractable and the port provided with a suitable cover. Grit arrestors are fitted although it must not be assumed that the carry-over is appreciable. The main function of an "after-chamber" is to ensure complete combustion before the products enter the boiler flues; nevertheless, when starting up, or on increasing the load, some unburnt particles are liable to get through the system. The grit arrestor in this case provides a parking space for these unburnt chips until they have smouldered away.

Whether to fit a wet or dry grit arrestor, assuming one is necessary, is a matter of temperature. For by-pass plants where there is no summer demand for steam, and its blowing off of the safety valve is likely to be an embarrassment, a water bath grit arrestor becomes a necessity. Unless one is prepared to go to the expense of providing a fire brick lined brick chimney and to emit products of combustion at a very high temperature, a water bath has to be designed to absorb almost the same amount of heat from the fuel as does the boiler

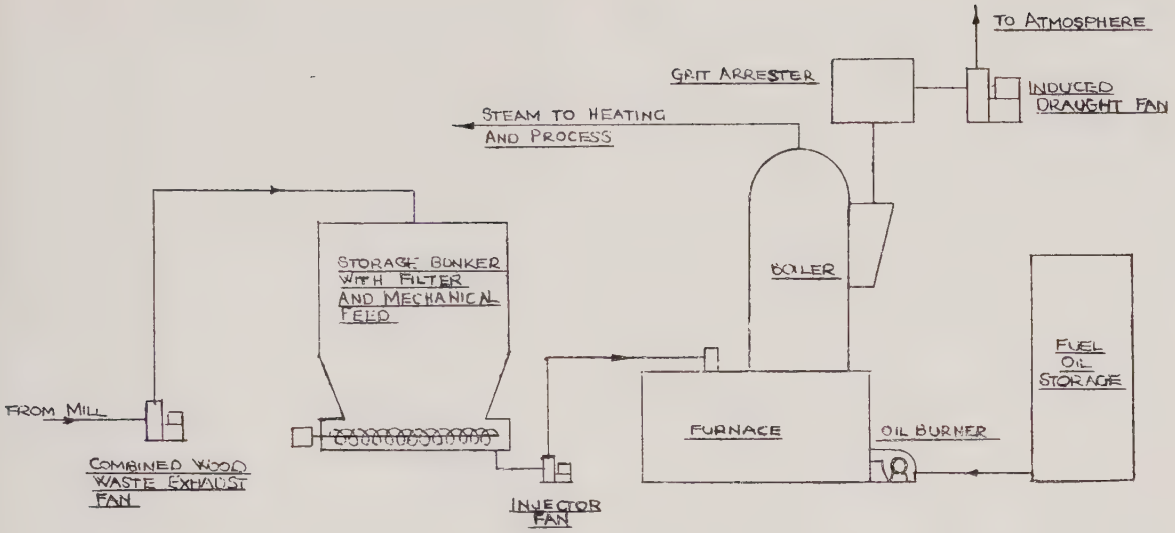



**Figure 3**

in winter time. This applies also to incinerators without means of heat recovery and it follows that the area of water and the degree of contact which the gases are compelled to make has to be related to the amount of fuel burnt.

For many years difficulty was experienced in disposing of "sander dust." There was always the danger of flash back where hand firing was in operation. Various rotary paddles have been tried to handle this material with some success, but with modern methods of high velocity injection the burning of sawdust can be made quite safe either by itself and as a mixture with wood chips. It is now possible to exhaust all machines on one plant and to discharge all waste into a combined storage bunker, with controllable mechanical extraction at the bottom feeding into suitable furnace equipment as shown in Fig. 3.

The important point when dealing with any fuel is, of course, to feed the fire grate at an even rate, adjustable at the will of the operator. In the case of mixed waste, chips, sawdust, sander dust, etc., the container should be capable of discharging into the furnace at a known predetermined, and infinitely variable, rate. An excellent plant is the Surge Storage Silo, Fig. 4. As the supply of waste may be spasmodic, the silo acts as a reservoir with a rising and falling level of material according to the amount going forward from the mill.

The Surge Silo is a circular container with its top diameter smaller than its base in order that the shape of the sides approximates the angle of repose of the material, the reason for this being to minimize the danger of arching. The base is a revolving floor which has two speeds, $\frac{1}{8}$ r.p.m. and $\frac{1}{4}$ r.p.m., powered by a two-speed motor. From the centre of this floor and above it is situated a short extractor screw penetrating the side of the Silo thus discharging therefrom. The speed of this extractor screw is variable at the will of the operator within wide limits and ensures an even and predetermined rate of feed of waste to the furnace. A control box is provided on the wall of the boiler house remote from the plant by which the speed of the extractor screw can be regulated, this speed being indicated on a dial incorporated therein. The cyclone or cyclones can discharge their spoil into the silo at any rate and thus the sizes from the mill are completely ironed out at a steady and predetermined rate of flow. Where a waste heat boiler is incorporated in the plant, it will be appreciated that the inclusion of this Surge Storage Silo means greater heat yield per lb. of waste, and leads to more efficient combustion, thereby increasing the throughput of the furnace on this account. On wood

waste plants fed in this way, once the amount of waste being fed into the furnace is set, it will continue to feed at this particular rate indefinitely, whilst there is material in the silo. Knowing the rate of delivery, the primary and secondary air supplies may be adjusted to give optimum combustion conditions, thus preventing smoke production.

**General Waste**

My remarks up to the present have been almost entirely devoted to the burning of wood waste, but other possibilities remain in the form of general industrial waste, municipal refuse, plastics waste, and all manner of residues arising from the newer industries, which will repay the study necessary to enable them to be successfully burnt for heat recovery.

Small quantities of refuse may be fired on heating type boilers by hand, either alone, or in conjunction with coke or coal. Conventional fuels may be applied by an underfeed stoker, and the waste material fed by hand on top of the fire. The advantage of the heating boiler is its large combustion chamber which is a characteristic feature and can accommodate the greater bulk of refuse, although the possibility of long firing intervals, which is the reason for the large combustion chamber, is lost.

Some steel heating boilers intended for burning refuse are provided with a connection directly from the combustion chamber to the chimney, bypassing the tubular section of the boiler in order that they may be used as incinerators during the summer time. Here again, as I have already mentioned, facilities must be provided for dissipating the heat generated in the combustion chamber and also for dealing with high gas temperatures involved in discharging products of combustion directly to the chimney particularly where the refuse contains a high proportion of wood waste.

Waste may also be fired by hand or automatically into the furnace of horizontal shell boilers, either alone, or in combination with another solid fuel, but the lack of combustion space can present serious difficulties if any but very small quantities are fired at one time. The materials should be charged to the front of the grate only, so that the volatiles which are given off very quickly pass over a hot fire-bed on the back of the grate and are thus ignited. By wetting the waste, particularly the wood content, before firing, the release of volatiles may be slowed down considerably. Where automatic firing is employed steps must be taken to minimize the possibility of flame flash back into delivery trunking causing serious fire in the cyclone or storage silo.

Furnaces having adequate combustion space are best for burning waste materials, and may take the form of a gas producer, dutch oven, or step grate furnace. An exception arises in the case of the water tube boiler where the large combustion chamber makes the burning of waste within the boiler practicable. Probably the most efficient of these appliances is the gas producer. Here a deep fire can be maintained and the gas producer reaction reduces the amount of heat generated in the producer itself and transfers the major part of the combustion process into the boiler proper. The dutch oven and step grate furnace do give a producer gas reaction if they are large enough and a deep fire can be maintained, but otherwise combustion is largely completed in the primary furnace and little or none takes place in the boiler proper. For this reason, a boiler which depends for the greatest part of its output on radiant heat (Lancashire boiler) is not as satisfactory as one largely dependent on conducted heat (*i.e.* Economic or Tubular Waste Heat boiler).

On the question of economics it is interesting to note that some refuse disposal plants where the heat so recovered is fully utilized throughout the year, the entire capital cost of the installation is returned in about five years. This, you will agree, constitutes a remarkable investment both for the individual company and the nation as

a whole. Inevitably, with these types of installations, the manufacturers have always been involved in the smoke and grit emission problem, and generally speaking, most plants have been reasonably satisfactory in this respect. The Clean Air Act has, however, led to developments calling for even more efficiency, and this question is emphasised with the introduction, in recent years, of the manufacture of plastics and other synthetic materials.

Fig. 4 indicates a standard arrangement of a plant for the disposal of wood waste. You will observe that a waste heat boiler is included and also a by-pass flue for isolating the same at need, the outlet from either leading to a dust and fragment intercepting chamber of the water trough type. The gases then pass forward to the chimney as shown.

Perhaps at this stage it is prudent to include a few notes on the Hoskinson Smokeless Incinerator which is an appliance fitted with a heat exchanger capable of providing hot air either for space heating or heat for existing central heating plants. This incinerator consumes all types of rubbish and the smoke eliminator at all times ensures a smokeless emission from the chimney. An oil burner fitted to the furnace ensures that space heating, etc. can continue when available rubbish has been disposed of. Depending upon the heat content of the rubbish being fired the incinerator has a heat output of from 250,000 B.Th.U's to 500,000 B.Th.U's per hour and consumes 300 lbs. of rubbish an hour. Heat output when firing with the automatic oil burner may be adjusted by a thermostat. The incinerator may be sited inside or outside the building. The fundamental principle of smoke-eliminating equipment is to supply air for combustion and a temperature for ignition. The air from the fan passes through a special diffuser and supports the combustion of the ignited oil flame and air to mix with the smoke which burns continuously within the inner stack. The chimney is designed as a carburettor and consists essentially of two concentric cylinders. Air passes into the annular space and by thermo-cycle passes upwards, where it enters the chimney. This highly preheated air then mixes with the remainder of the smoke and complete

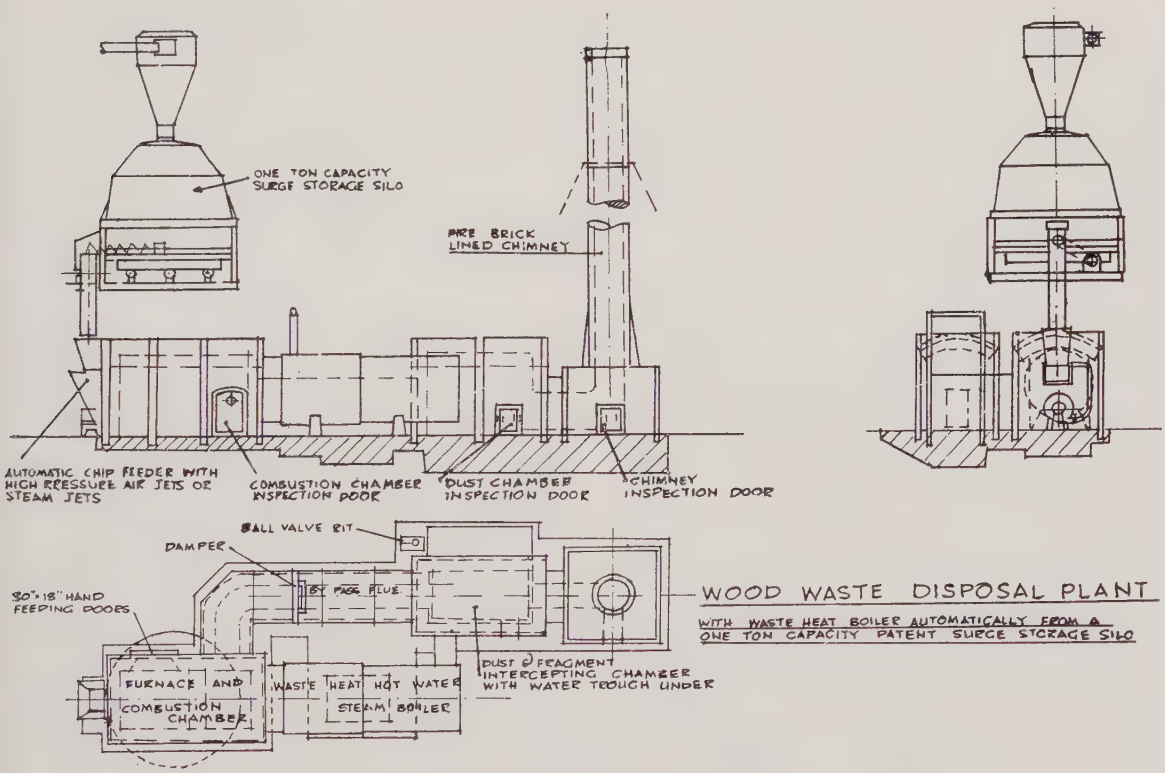



**Figure 4**

combustion of the gases is assured. This oil burning arrangement will consume all smoke from any type of rubbish. Space heating is achieved by blowing air through a heat exchanger. The gases from the furnace pass through the inner space imparting their heat to the air before passing into the chimney and smoke-eliminating chamber.

The critical problem of waste and rubbish disposal faces every 20th century industrial and commercial undertaking and this incinerator has been specially designed to solve this problem by burning any combustible material completely smokelessly at the rate of 300 lbs. per hour. Rubbish has become valuable fuel and when burned on an ordinary incinerator the heat is simply released into the atmosphere. With the built-in heat exchanger, rubbish heat is transformed into useful space heating, either in the form of hot air or hot water. The heat exchanger also acts as a built-in grit arrestor.

Another form of destructor for use in hospitals is a furnace specially designed to deal with waste obtaining at these institutions, and in most cases a drying hearth is provided for the disposal of amputations, pathological remains, etc. Here again, waste heat units may be incorporated and the plant fitted with a water screen and dust chamber if necessary according to its particular duty. Gas or oil firing with forced draught may be included.

It is interesting to learn that Meldrum Flood-Page Ltd. have just concluded a large contract with the Bank of England for provision of a disposal plant to deal with 75 tons of returned banknotes per week, the heat recovery unit being for a high pressure hot water system with a total rating of 11,000,000 B.Th.U's per hour. There is no smoke or grit emission, the whole plant being automatically fed and operated remotely from a control room.

It is quite true to say that there are installations which have disposed of waste ranging from banknotes to elephants and if there are any particular problems to be dealt with there is the technical ability available today to deal with them.

**Grit Emission**

Grit emission has been investigated over many years by Messrs. Meldrum Flood-Page Ltd., and they have invented and patented various types of water screens which are placed athwart the dust and fragment intercepting chambers. The apparatus consists of three banks of tubes fed with water from a header. In plan the rows of tubes are staggered in relation to each other and all the tubes are open-ended at the top. The water fed via the header rises in the tubes and is allowed to brim over, flowing down the outside of the tubes thus providing a wall of running water. The gases en route to the chimney will obviously have to pass between the tubes, changing direction in doing so, and the velocity of the gases which is normally about 20 feet per sec., throws out the heavier fragments into the running water whilst the dust is drawn into the same by capillary attraction. As soon as the grit and dust touch the water, they are immediately "killed" and washed down into the trough beneath the dust chamber, which may be formed in the foundations. In the bigger plants the water flow can be substantial and it is generally desirable to recirculate on account of economy. The water absorbs a certain amount of heat and therefore it is usual to supply a tank of at least three hours retention capacity. This tank may be either above or below the screen, the water being fed to the screen by gravity or by pump. The water screen referred to above can be applied to most combustion plants and the plant you have seen at Andrews' Heels Ltd. is serving a Cornish type Economic boiler. In this case you will have noticed the chimney is removed from the top of the boiler and placed alongside, the outlet being joined to the chimney by a horizontal branch. In this branch is installed the expansion chamber in which is placed the water screen. The

external tube is a "tell tale tube" being the same height as the tubes inside the chamber, so that when the water is flowing the operator has evidence of the internal operations. Where the gases contain corrosive elements such as sulphur, the acid effect may be neutralized chemically.

There are several known methods of grit and dust removal. Settling chambers as such are not often used for separating coarser particles from flue gases because their efficiency is very low, unless the chambers are of an impractically large size. They are combined with a change in direction of the flue gas so that action is assisted by centrifugal force. There are numerous variants of the Scroll Collector which is a dust removing fan which works at up to 80 per cent. efficiency on stoker fired boilers. Cyclones have been in use for many years and the principle no doubt is well known, whereby a gas vortex is used to impart centrifugal force to solid particles suspended in the gas. The Cellular Type Collector consists of a number of cells working in parallel and has many advantages. The cells may be built up in banks and when arranged horizontally these banks form a compact installation. It is said that a maximum efficiency of 95 per cent may be obtained. The various types of collector have a wide range of efficiencies although some do not have high efficiencies on small particle size. All vary a great deal according to loading and condition of operation as well as design detail. Electrical precipitation is widely used, in fact almost exclusively for the separation of fly ash from large pulverised fuel fired boilers at power stations, and large factories. The principle is simple; the original precipitator was the wire in the tube type in which the high tension discharge wire electrode was suspended axially in an earth collecting tubular electrode, arranged vertically. This is still one of the main types used in flue dust precipitation, but the tubes are usually made hexagonally and formed into a nest to save ground space.

May I express my sincere thanks to the following who have been kind enough to make available technical data and engineering drawings for use in the preparation of this Paper:

Meldrum Flood-Page Ltd., Combustion Engineers.

Boston Marine & General Engineering Co. Ltd.

G. F. Rider (Process Plant) Ltd., Heating, etc. Engineers.

The National Industrial Fuel Efficiency Service.

Dodman & Co. Ltd., Engineers, King's Lynn.

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## OBITUARY

We regret to record the recent death, at the age of 81, of T. E. Birtwisle, formerly Chief Sanitary Inspector for Castleford, and before his retirement an active advocate for clean air in the West Riding. He represented his authority for many years at the Society's meetings and conferences, and was a prominent member of what is now the Association of Public Health Inspectors. His son, T. E. Birtwisle, C.P.H.I. for Horsforth is a member of the Society's Executive Council.

As we go to press we regret to learn of the death, on August 19th, of Dr. W. A. Macfarlane, managing director of the National Industrial Fuel Efficiency Service. Dr. Macfarlane was well known to many of our members, and many will recall his address on fuel efficiency at the Scarborough Conference, 1954, when he presided over one of the sessions. He was a well-known figure in the world of fuel, and this year was President of the Institute of Fuel.

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Legal action has been taken against the owners of four vessels in respect of contraventions under Section 1 of the Clean Air Act, 1956. All pleaded guilty and fines totalling £55 were imposed in the Magistrates' Court.—*Dr. Alexander Hutchison, Port MO, Hull and Goole Port Health Authority, in his Report for 1960.*

## Clean Air Progress in London

An address on progress under the Clean Air Act was given to the annual general meeting, in the House of Lords on June 2nd, of the London and Home Counties Advisory Council for Clean Air, by Arnold Marsh, Director of the N.S.C.A.

Mr. Marsh mentioned that the Advisory Council, which is a solely local authority body, was formed in 1938 at the initiative of his Society, and that he had acted as its honorary secretary for a number of years. He recalled that its inaugural meeting had heard an address by the late Dr. J. S. Owens on "Smoke Abatement in Greater London." Mr. Marsh had tried to compare the latest air pollution measurement figures with the figures given by Dr. Owens at that time. The average deposits for eight London stations, over four decades for which records were available, showed the extent of the progress that had been made. In tons per square mile the deposits per annum were as follows:

| | |
|---|---|
| 1915-16 .. | .. 415 |
| 1917-18 .. | .. 379 |
| 1927-28 .. | .. 316 |
| 1936-37 .. | .. 238 |
| 1957-58 .. | .. 170 |

The speaker said that although progress in the creation of smoke control areas was in some respects disappointingly slow, Metropolitan and Greater London appeared to be in advance of the rest of the country. In terms of acreage, the figures for the end of January, 1961, showed that 12·2 per cent. of the County of London was covered by smoke control areas, and for Outer London the percentage was 4·2. In all, 15,631 acres of smokeless zones and control areas now existed in the 237,178 acres of Greater London given in their "final acreage" returns by the Authorities to the Ministry.

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## Smokeless Fuel Prospects in Scotland

A Scottish firm has designed plant which will produce smokeless fuel from coal. At the request of the National Coal Board, tests with prototype equipment are being carried out at the company's factory in Fife. Although the research is by no means complete, results so far—using a wide variety of Scots coal—have been satisfactory.

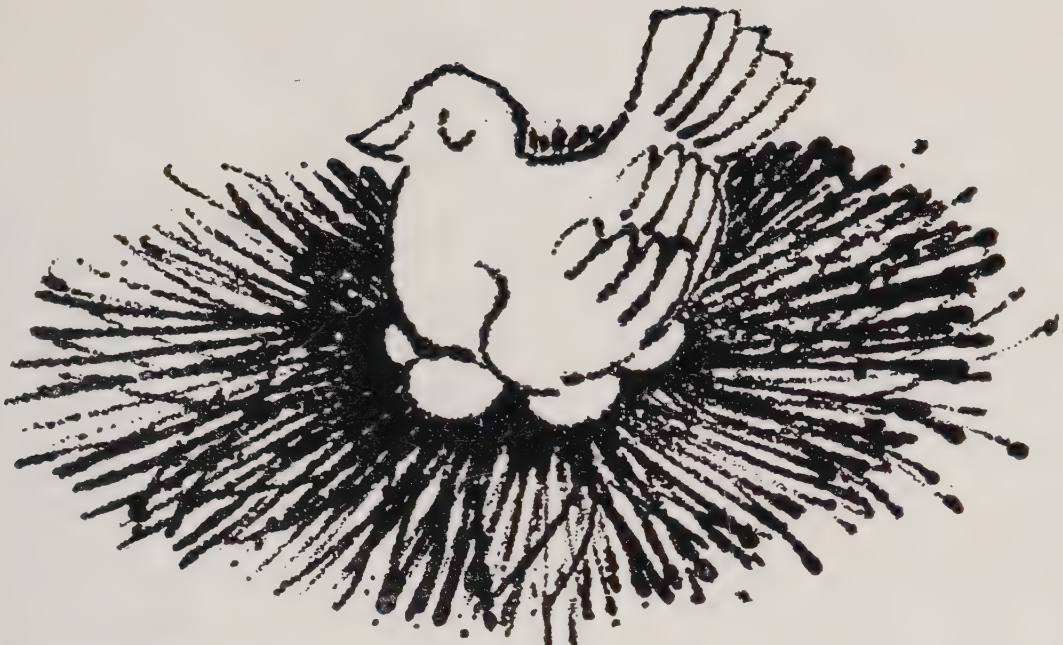
The company on the verge of this breakthrough are Henry Balfour of Leven, one of Britain's leading manufacturers of chemical plant. Their process, if the experiments are successful as they now promise to be, will be a welcome addition to the Coal Board's own development, being carried out in England under Dr. J. Bronowski. The N.C.B. are committed to supplying at least one million tons of smokeless fuel annually within a few years and they have been testing pilot plants, set up at Birch Coppice in the West Midlands and Graigola in the South Western Division.

### Capital Cost Less

The possibilities of the Scottish project are very attractive because it may lead to a cheaper fuel than was expected from the Bronowski process. For example, the capital cost of the plant involved is much less. Another good point from a Scottish view is that the Balfour process has been dealing with a wide variety of Scots coals.

As Mr. R. W. Parker, chairman of the Scottish Division of the Coal Board, said earlier this year, the specifications of the Bronowski process were "very tight." At that time, it looked as if "some of the Scottish coals will be suitable." Despite these possible limitations, however, the Board had planned to establish a smokeless fuel plant in Scotland before 1965.

The Leven firm have been carrying out research into smokeless fuel for some four years and their process is entirely different from that developed by the N.C.B. The Balfour process takes coal "doubles" and "trebles" and removes the volatile matter by burning. The Bronowski process uses powdered coal and, after cleaning it with hot air, reconstitutes the powder into briquettes.—"*Scotsman*" *Report.*



# Electricity makes a clean sweep

In fact, electricity cuts out sweeping, and any other kind of dirty work. Electric floor warming, for instance, can provide warmth and comfort in any new building—office, factory or home—for a very moderate running cost. Also, it is cheap to install; electric floor warming obviates the need for fuel stores, chimneys, and (alas for an old and time-honoured profession!) the need for chimney sweeps.

Electric cleanliness is becoming more and more desired and desirable; where new housing is concerned, people choose electric cooking, because it keeps the kitchen clean and new looking. All round—electricity is the modern way. You just plug in and enjoy electric living.

*There'll always be plenty of electricity.* Nuclear energy will see to that. Thank goodness. For electricity promises that we and our children will breathe clean and healthy air.

ELECTRICAL DEVELOPMENT ASSOCIATION
2 SAVOY HILL, LONDON, W.C.2
TEL: TEMPLE BAR 9434

## THE FUTURE IS ELECTRIC

# *Rehousing in Birkenhead*

**Warm Air Heating by Gas Chosen**

Of great interest to all those concerned with the promotion of clean air in the North West is an agreement entered into by Birkenhead Corporation and the North Western Gas Board to provide heating by gas fired fanned warm air and hot water heated by gas, throughout a massive rehousing scheme, consisting of four 14-storey blocks and three 11-storey blocks of flats together with eight 4-storey blocks of maisonnettes. Altogether 525 families will be housed.

The first block of maisonnettes to be completed at Queensbury Street, Birkenhead, was opened recently by the Mayor, Alderman H. D. Shakeshaft, after it had been formally handed over to the Chairman of Birkenhead Housing Committee, Alderman J. H. Roberts, J.P., by Mr. P. Ainley, a director of George Wimpey & Co. Ltd., the builders. All the maisonnettes on this site are now ready for occupation and the first 11-storey block of flats is approaching completion.



*Some of the Queensbury Street Maisonettes*

**Low Cost**

After close investigation into the comparative costs and efficiency of heating by various types of competitive fuel, and direct experience of one fuel, the Housing Committee decided in favour of gas for installation throughout the rehousing programme.

This decision was made on the grounds of smokelessness, comfort, labour-saving and low capital and running costs. For the tenants it will mean comparative freedom from dirt, no fire-lighting or fuel carrying, less housework, less redecoration and smaller fuel bills.

Each flat has its own separate fanned warm air heating system which can be controlled by the tenant to his individual warmth requirements. There is a gas-fired instantaneous water heater providing a constant hot water supply in each flat, and gas points are fitted for a gas cooker, gas refrigerator and gas washer. On each floor a communal gas-fired incinerator has been provided.

**Clock Control**

The heating system in each is thermostatically controlled and also clock-controlled to switch itself on or off automatically at times pre-set by the tenant. The warm air is directed through ducts to grilles set in the walls of the rooms where the heat is required, and the hot air is also harnessed to heat a capacious drying cabinet in which wet laundry can be dried quickly whatever the weather.

It is too soon to report the reactions of the new tenants to living with this new system, but judging by the satisfaction expressed by tenants of similar Corporation flats at Preston, it seems likely that the Birkenhead tenants will be pleased with its economy, efficiency and comfort.

The 11-storey block of flats at Preston, containing 66 dwellings, was the first multi-storey block of flats to be completed in the North West to have heat supplied by individual tenant controlled gas-fired fanned warm air systems and hot water supplied by gas-fired circulators.

# AIR POLLUTION ABSTRACTS

**535. "Analysis of Gases for Sulphur Oxides."** Wickert, K. (Brennstoff-Warme-Kraft, **12,** No. 10, p. 449). Tests which were carried out in an attempt to determine the sulphur dioxide and sulphur trioxide content of furnace and flue gases in one sampling have proved that neither solutions of iodine/potassium iodide nor isopropyl alcohol are suitable, because the residual oxygen in the flue gases releases some of the iodine of the potassium iodide and oxidises in isopropyl alcohol some of the sulphur dioxide to sulphur trioxide. Two new methods are free from these defects. In the direct method a 20 per cent caustic soda solution containing 3 per cent of a 40 per cent formaldehyde is used for adsorption of the gas. In the differential method, use is made of an iodine/starch iodide solution and of a n/2 caustic soda solution. The latter method, being based on the difference of two results, may introduce an error of up to 25 per cent and preference is given to the former. The $H_2S$ content is determined separately by passing it through a solution of cadmium acetate containing formaldehyde.

**536. Some Toxic Effects of Air Pollution on Public Health.** Katz, M. (Occup. Hlth. Rev., Ottawa 1960, **13,** 4-14; APCA, January, 1961, 6, 1). Before due consideration can be given to some of the toxic effects of air pollution, it is advisable to review the nature and composition of substances that pollute the community atmosphere. These may be divided into two classes; gases or vapours, particulate matter, consisting of liquid and solid particles over a wide size range. The most common gaseous contaminants in community air are carbon monoxide, sulphur dioxide, oxides of nitrogen, hydrocarbons, aldehydes, and ozone oxidants. It has been shown that certain toxicants have an adverse effect on muscle concentration and leucocyte metabolism.

**537. Review of Dust Assessment Techniques.** Ross, C. R. (Occup. Hlth. Rev., Ottawa, 1961, 1320-25; APCA, January, 1961, 6, 4). Most dust measurements are made to revaluate dust hazards so that they may be controlled. For this purpose four different assessment techniques which have been in use for some time are: konimeter, impinger, thermal precipitator and tyndallometer. Each of these methods has particular advantages and each has performed valuable service in controlling pneumoconiosis. All have limitations which make it difficult to compare it on such surveys by different techniques. For research investigations which require correlation of environmental data with pathological findings, sampling is more extensive and data gathered on the nature of air-borne dust and associated air contaminants are more detailed. Particle size measurements are commonly made in such studies. The four instruments mentioned are discussed in detail.

**538. Particle Size Analysis.** Selected Bibliography. November, 1959. Whitby, K. T. and McFarland, A. R. (Washington; U.S. Department of Health, Education and Welfare, PHS Division Air Pollution, November, 1960, 123 pages; APCA, January, 1961, 6, 8). This bibliography of 1,111 items published from 1900 to 1959, has been reproduced with the permission of the Department of Mechanical Engineering of the University of Minnesota and the Quaker Oats Company. The entries represent technical papers and books which deal with methods, both theoretical and practical, of determining particle size. A few references to news briefs and patents on new equipment are also listed.

**539. Apparatus for Smoke Detection.** A.E.I. Limited. (BP 862, 147/1961; Engineer, London, April 7th, 1961, 211, 571; Thornton Research Centre Engineering Abstracts, April 21st, 1961, 3). Brief details of proposed method for detecting smoke particles in a gaseous flow by detecting the electrical charge derived from the particles. A small fraction of the smoke is sucked into a test chamber containing a centre wire electrode to which a high negative potential is applied. The wall of an adjacent tube, insulated from the first acts as a collector electrode and a volt meter indicates the rate of charge transferred to the wall as the solid particles are discharged. Diagram included.

**540. Air Pollution Administrative Control—A Local Responsibility.** Best, G. E. (J. Air Poll. Control Assoc., April, 1961, **11,** 155, 156). The purpose of this paper is to show that administration of air pollution control, as a public function, should be in local hands.

**541. Why Air Pollution Control should be Enforced at a Local Level.** Couchman, C. E. (J. Air Pollut. Contr. Assoc., April, 1961, **11,** 173, 174). The object of this Paper is to show that at the local level an air pollution enforcement programme is more economical and is in a favourable position to render its services more promptly to the citizens.

**542. Evaluating Air Pollution Problems.** McCaldin, R. O. (Ama. Arch. Environmental. Health, March, 1961, **2,** 228-233). Some of the more common equipment used in making environmental air quality determinations is described. It is emphasized that a complete air pollution investigation should include an evaluation of emission sources, a study of meteorological conditions, and evaluation of the effects produced by air pollutants. 17 references.

**543. Air Pollution Standards.** MacKenzie, V. G. (Ama. Arch. Environ. Hlth, March, 1961, **2,** 224-227). This Paper presents a general discussion of emission and ambient air standards, the relationship between them, and the difficulties of establishing legal standards. Brief reference is made to the work of the California State Health Department to establish ambient air standards for oxidants, sulphur dioxide, carbon monoxide and particulates.

**544. Exhaust Composition in Relation to Fuel Composition.** Neligan, R. E. *et al.* (J. Air Pollut. Control Assoc., April, 1961, **11,** 178-186). Among the six fuels studied it was found that the hydro-carbon composition of the integrated exhaust gases was in each case related to the composition of its parent fuel. The make-up of the fuel determines the exhaust composition not only in regard to relative concentrations of the unburned fuel components, but also the types and quantities of products produced.

**545. Air Pollution Problems of the Foundry Industry.** Informative Report No. 1. Webber, H. J. (J. Air. Pollut. Control Assoc., April, 1961, **11,** 157-162).

**546. Air Pollution Problems of the Foundry Industry.** Informative Report No. 2. Gray Iron Foundry Practise and Air Pollution. Webber, H. J. (J. Air. Pollut. Control. Assoc., April, 1961, **11,** 162-165). This Report is intended to furnish a brief description of typical foundry operations.

**547. Air Pollution Problems of the Foundry Industry.** Informative Report No. 3. Air Pollution Problems of the Investment Casting Process. Webber, H. J. (J. Air Pollut. Control Assoc., April, 1961, **11,** 165-166). The investment casting process is a minor contributor to the overall air pollution problem in an area.

**548. Air Pollution Problems of the Foundry Industry.** Informative Report No. 4. Instruments and Techniques for Measuring Foundry Air Pollution Emissions. Appendices A and B. Webber, H. J. (J. Air Pollut. Control Assoc., April, 1961, **11,** 166-172).

**549. " Double-Scrubbing " for Smoke Fumes.** Anon. (Gas World, February 4th, 1961, 153, 207). A new venturi scrubber has been introduced for collecting solids from all kinds of industrial fumes, smokes or exhaust gases. " Double-scrubbing " action is attained by introducing the water ahead of the venturi so that the gases are compelled to pass through two complete cones of water, one of which has relatively large water droplets to cope with coarser solid particles, and the other smaller droplets for finer particles. At the same time the velocity of the gas and dust particles increases as it passes the venturi, resulting in maximum collection efficiency of the finest of particles.

**550. High-Sensitivity Recording Optical and Density Meter.** Collins, K. E. and Steele, D. J. (J. Sci. Instrum., May, 1961, **38,** 186-190). A recording optical smoke meter is described which has a high sensitivity. The optical density of smoke in a flue is compared by photoelectric means with that of an optical wedge, which is then rotated by an electrically-operated servo-system until the two densities are the same. The angular position of the wedge is detected by a transducer, which provides a millivolt output proportional to the rotation of the wedge. A multi-channel switching unit, electrically coupled to a recorder, is incorporated; this enables any number of different flue units, up to the capacity of the recorder, to be used or other variables to be recorded at the same time.

**551. A Study of the Relation of Visibility to Air Pollution.** Burt, E. W. (Amer. Ind. Hyg. Assoc. J., April, 1961, **22,** 102-108). Attempts to determine a workable relationship between visibility and the soiling index of air sampling tapes are described. It is shown that visibility is a function of relative humidity, whereas soiling index is not. Albeit the visibility-

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soiling index-humidity co-relations were significantly different from zero at a higher level of confidence, they were not of such quality as to permit good quantitative estimates of soiling index from measurements of visibility and humidity. The reproducability of soiling index within reasonable limits is questioned, since under nearly identical visibility and humidity conditions the soiling index values vary over a relatively wide range. 14 references.

**552. Air Pollution and Respiratory Disease.** A Preliminary Report. Dohan, F. C. and Taylor, E. W. (Amer. J. Med. Sci., September, 1960, **240,** 337-339; Publ. Hlth. Engng. Abstrs., April, 1961, **41,** 5). A high co-relation between the average concentration of an air pollutant (sulphates) and the incidents of respiratory diseases in women working in five cities has been demonstrated. This in association with other information suggests that susceptibility to or duration of some common respiratory infections is increased by exposure to the air pollutants measured as sulphates. 5 references.

**553. A Probe for Studying the Deposition of Solid Material from Flue Gas at High Temperatures.** Jackson, P. J. and Raask, E. (J. Inst. Fuel, July, 1961, **34,** 275-280). A simple and robust air-cooled probe providing a reproducible and easily manipulated target of known, variable temperature, has been used to study the deposition of fuel-ash constituents from flue gas in boilers. It can realistically simulate heat-transfer elements at metal temperatures up to 900° C. in boiler combustion chambers and super heaters: some typical results are quoted. The operating procedure for the probe equipment is described, and methods for the examination of the collected deposits are recommended. An automatic temperature controller is used for extended exposures. All the equipment is available commercially.

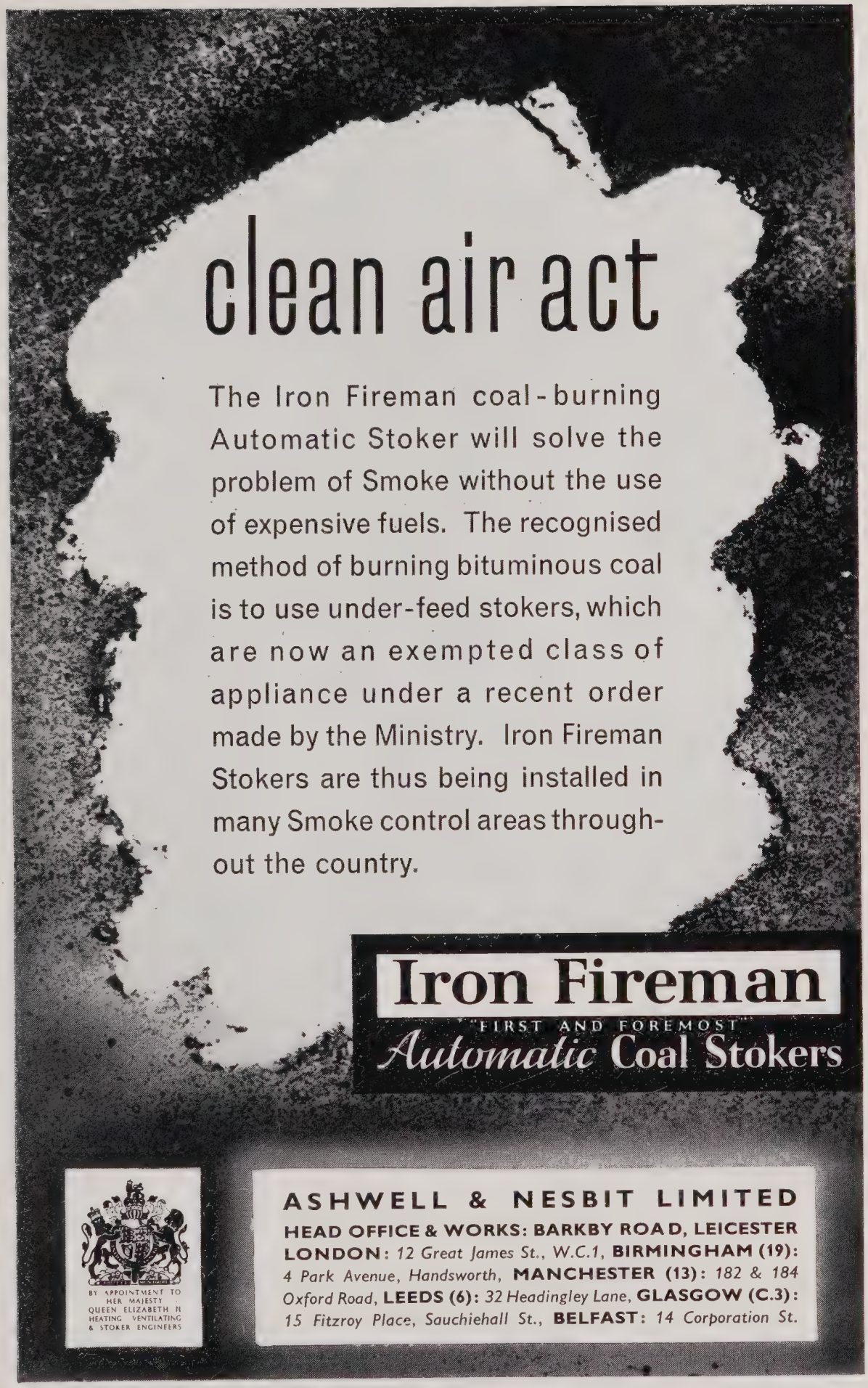
**554. Operating Procedures which help Reduce Air Pollution.** Informative Report No. 5. Air Pollution Control Association (J. Air Pollution Control Association, May, 1961, **11,** 233-234). This Report lists thirteen recommended procedures for foundrymen. If followed, these practices should result in a reduction in emission and localized fall-out of larger particles and release of small particles at maximum plant elevations, which is usually better than low level release. There should be a decrease in overall emissions.

**555. Legal Limitations on Emissions from Foundry Operations.** Informative Report No. 6. Air Pollution Control Association (J. Air Pollution Control Association, May, 1961, **11,** 234-236). Sections of the Report are devoted to: recommended ordinance provisions relating to foundry air pollution emissions; basis for determining allowable limits of emissions; ordinance provisions not applicable to foundry melting operations; and types of ordinances not recommended for general application.

**556. Available Control Equipment (for Application to Foundry Operations).** Informative Report No. 7. Air Pollution Control Association (J. Air Pollution Control Association, May, 1961, 11, 236-240). An attempt is made to show the various pertinent characteristics of the equipment available and match them to the particular requirements found in a foundry and indicate the advantages, disadvantages and limitations. 14 references.

**557. Medical Aspects of Air Pollution: An International Conference held in Vienna, August 29th, 1960.** Anon. (Conference, N.Y., October, 1960, **1,** (2), 1-20). Aspects discussed included: the problems of air pollution; findings from 10 years South Africa study; air pollution and lung cancer in Durban; lung damage in young emigrants to New Zealand; air pollution in East Pakistan; air pollution in Japan; U.S. findings confirm South African and New Zealand studies; lung cancer in French iron miners; air pollutants in Milan; do air pollutants cause bronchitis, bronchospasm, asthma? do air pollutants cause heart disease? can tolerance to air pollutants develop? adverse effects of air pollution on the old; how can we increase awareness of air pollution? and need for international research on air pollution.

**558. "Prevention of Low-Load Smoke from Spreader Stokers."** Engdahl, R. V. and Erion, W. A. (Coal Utilization, March, 1961, **15,** 15-16; APCA, June, 1961, **7,** 2). Collectors of the mechanical type are reasonably satisfactory on dust as large as 10 microns and above. Keeping the over fire draft down to the lowest possible level reduces the dust loading by decreasing air leakage. With the best of equipment, the abatement of low-load smoke depends primarily on the operator, who must anticipate load reductions and proceed to build up the fuel bed accordingly. Control of air leakage is important and effort to control it should begin with management.


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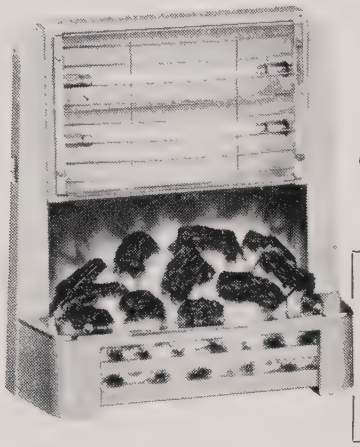
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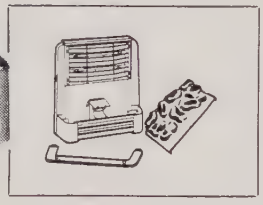
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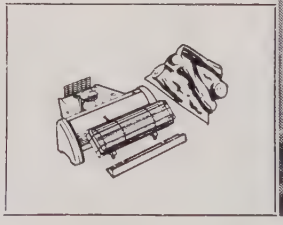
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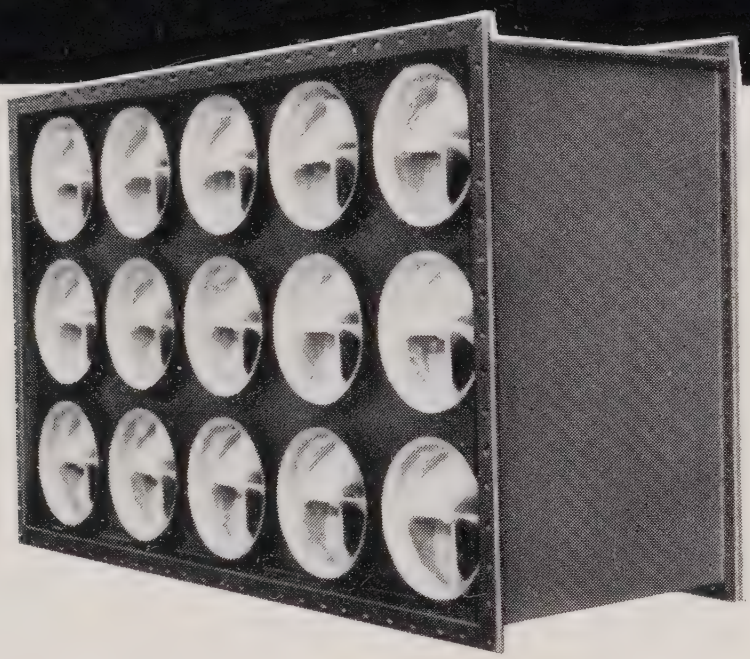
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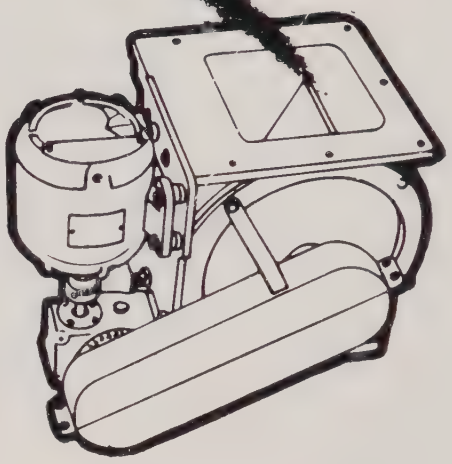
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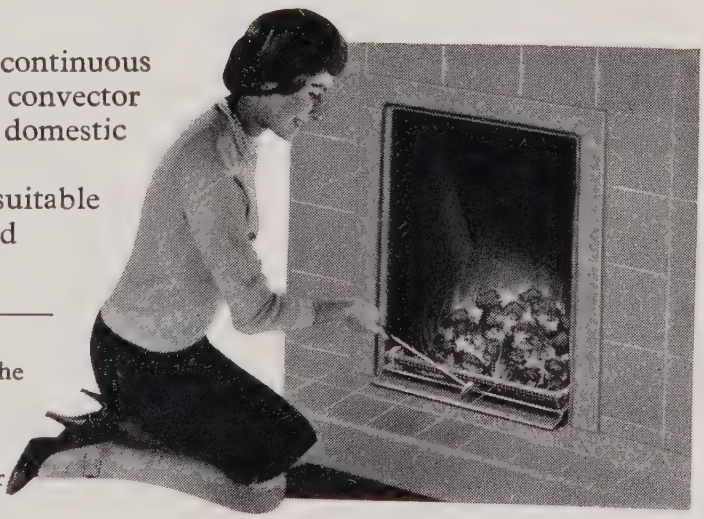
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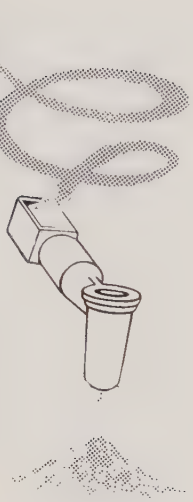
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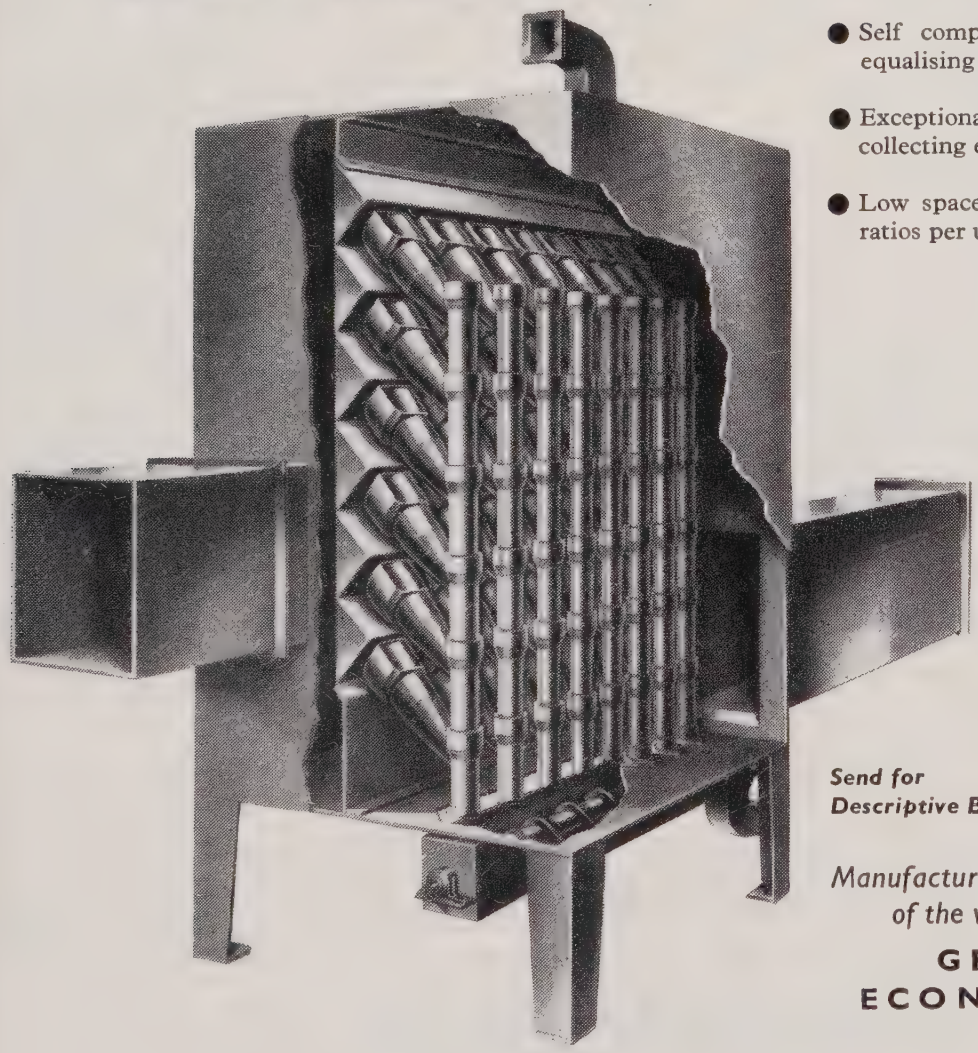
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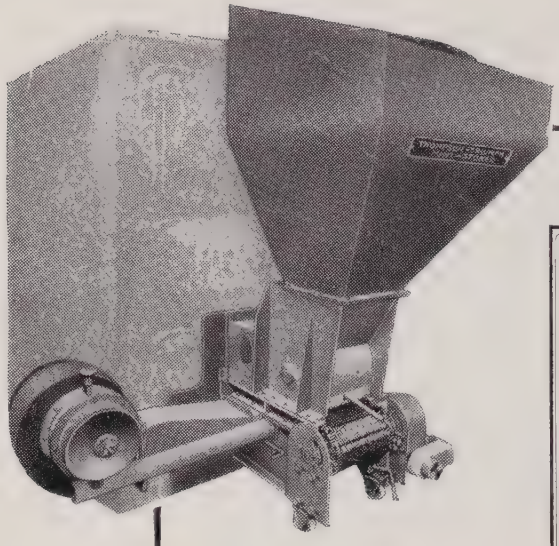
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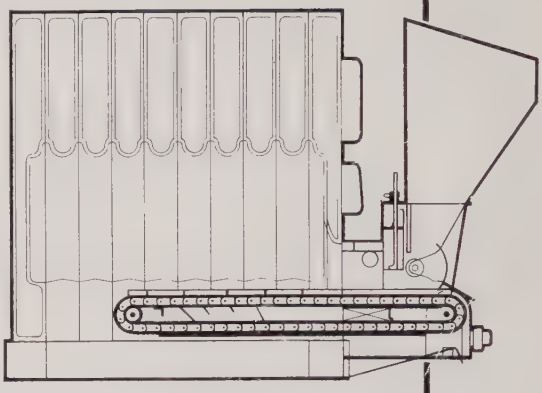
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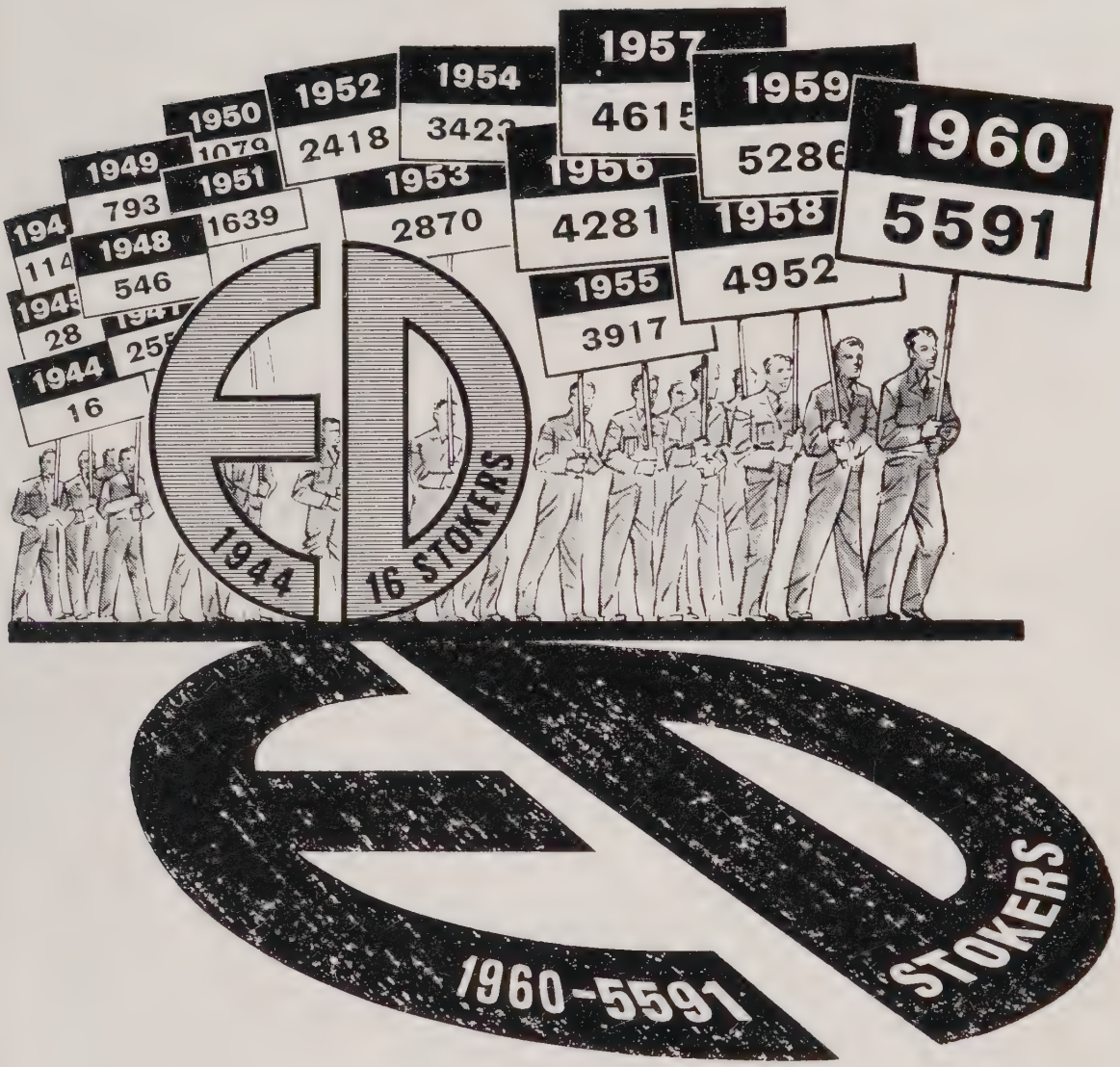
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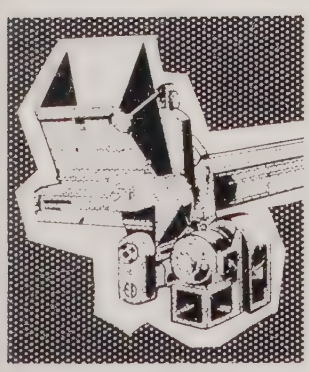
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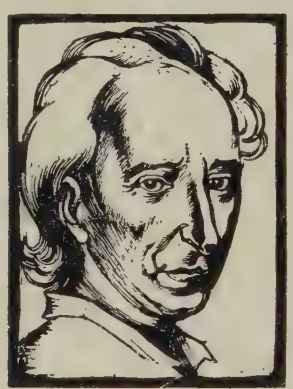
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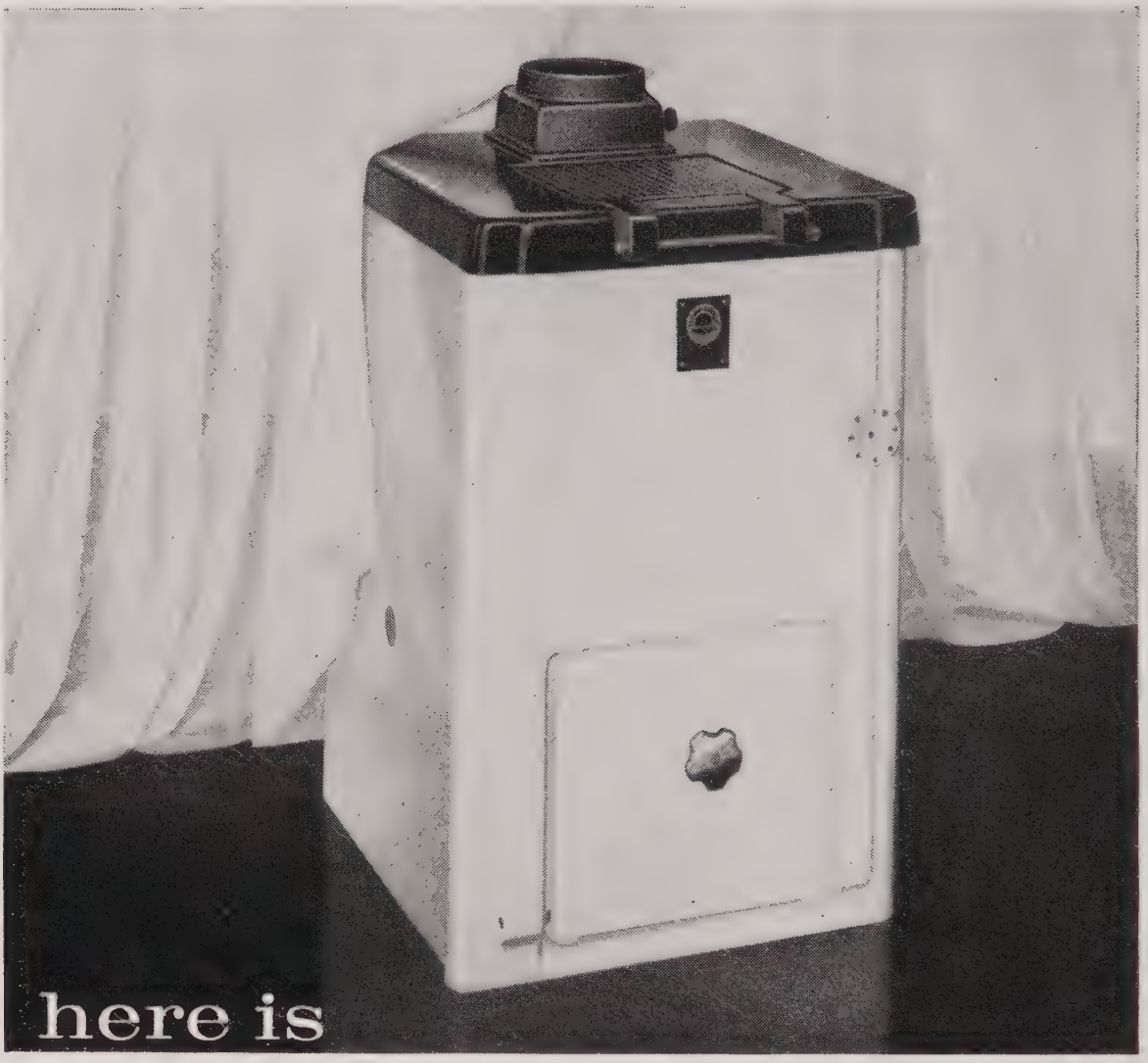


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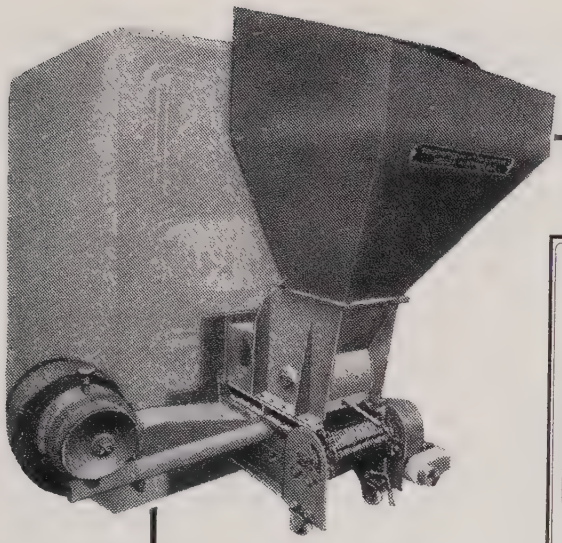

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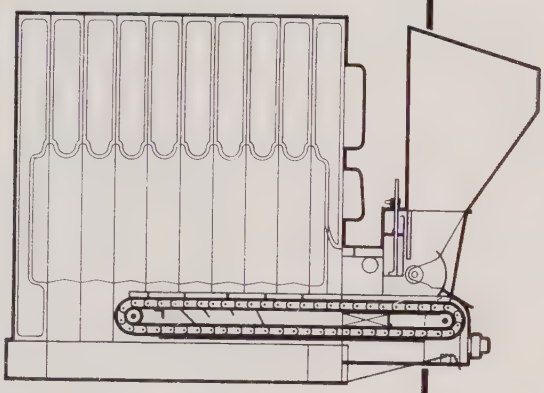
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*Automatic travelling grate*

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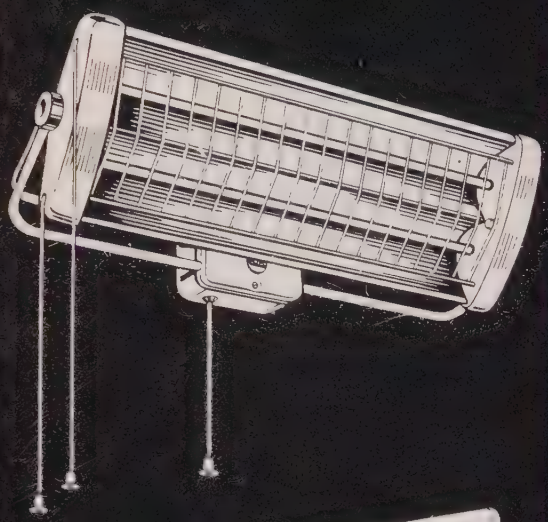
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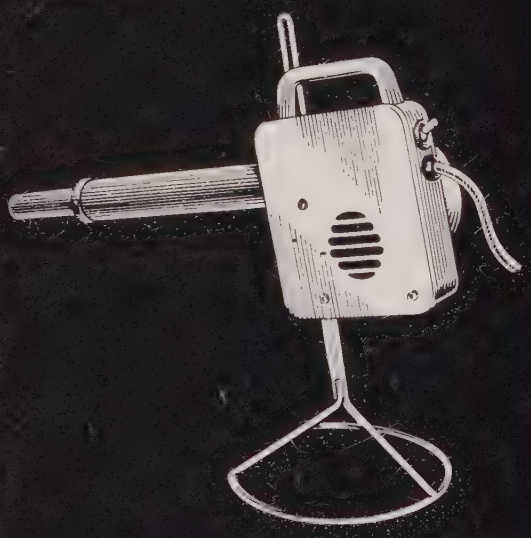


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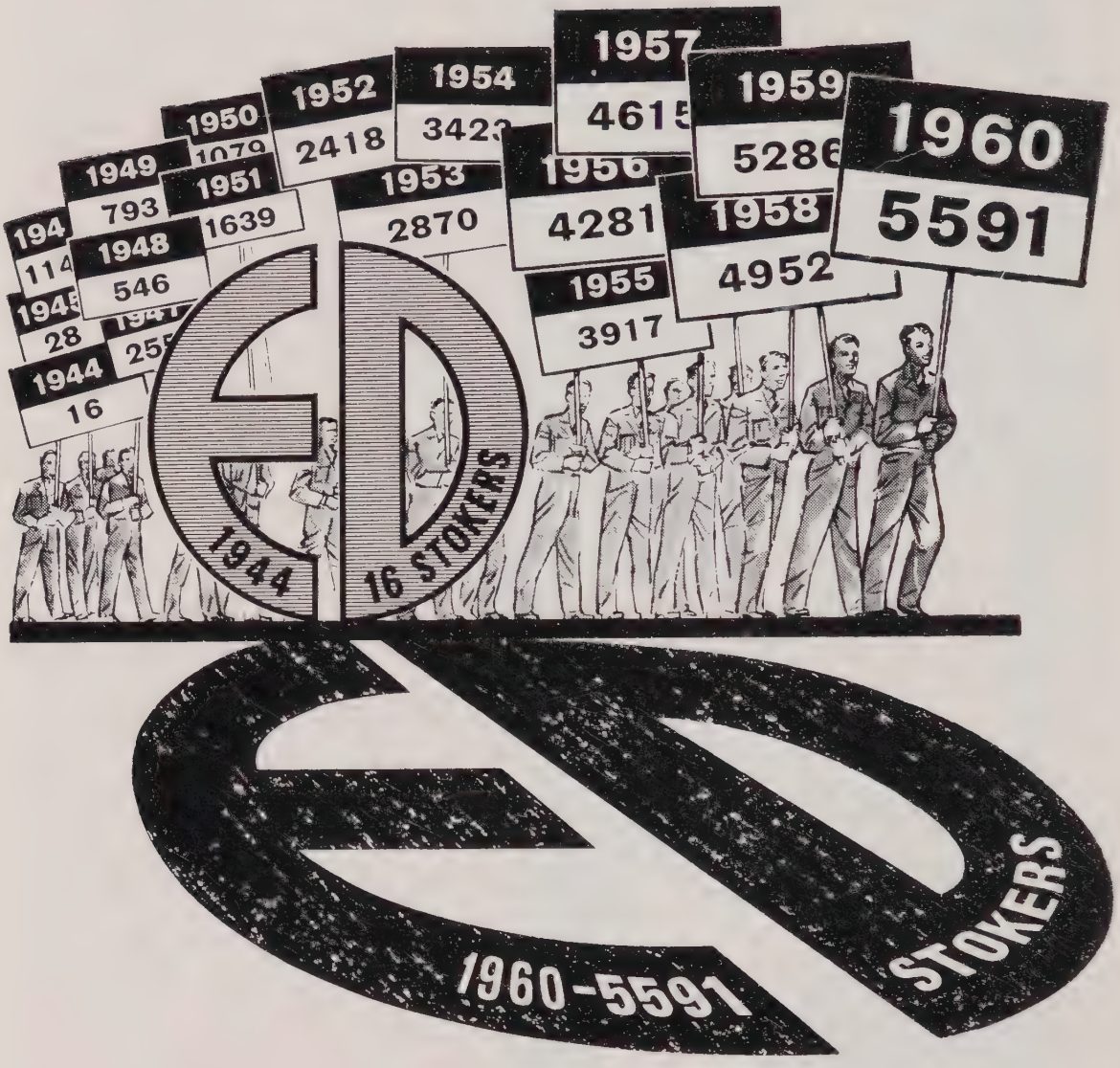
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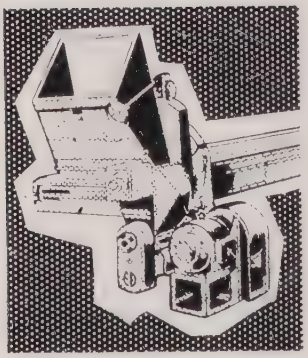
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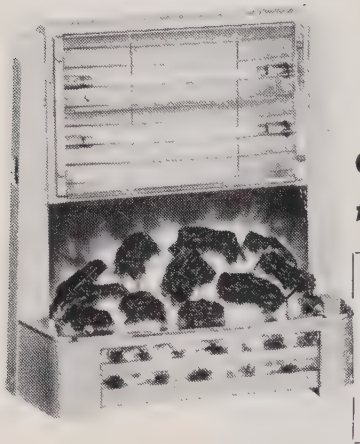
# For smoke control areas—

## Berry's FIXED HEATERS

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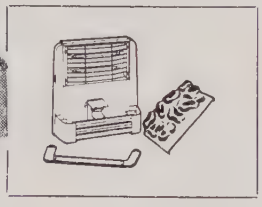
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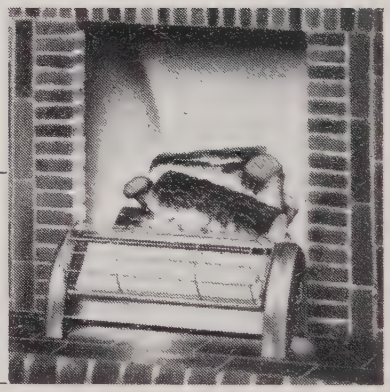


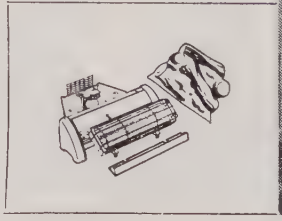
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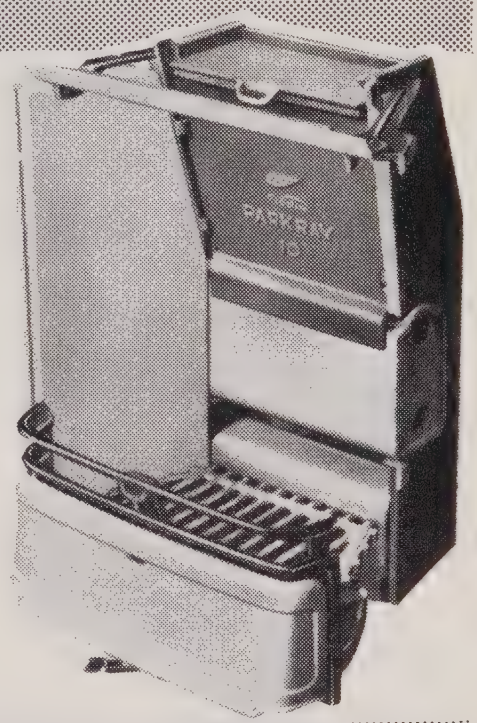
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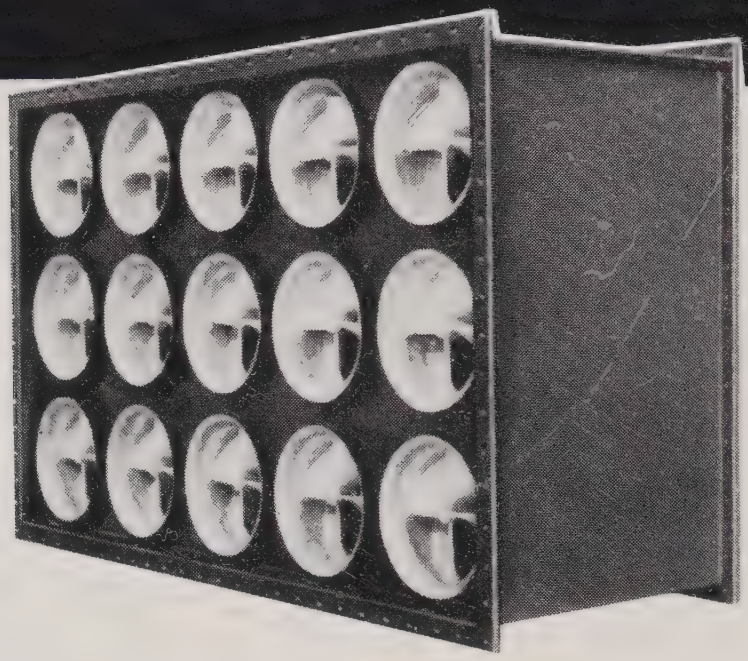
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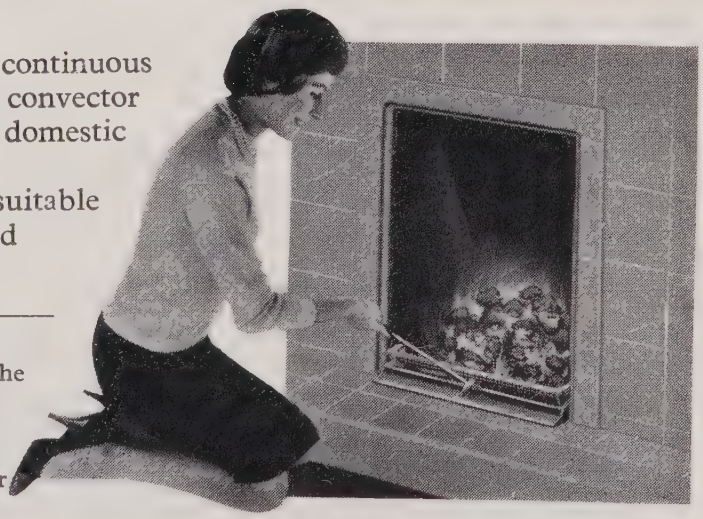
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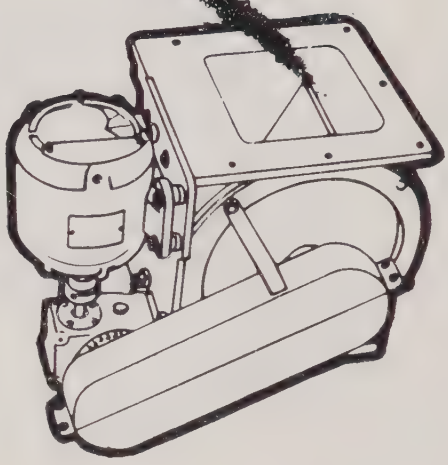
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MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application forms will be sent on request.

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# CONFERENCE AND EXHIBITION HARROGATE, 1962

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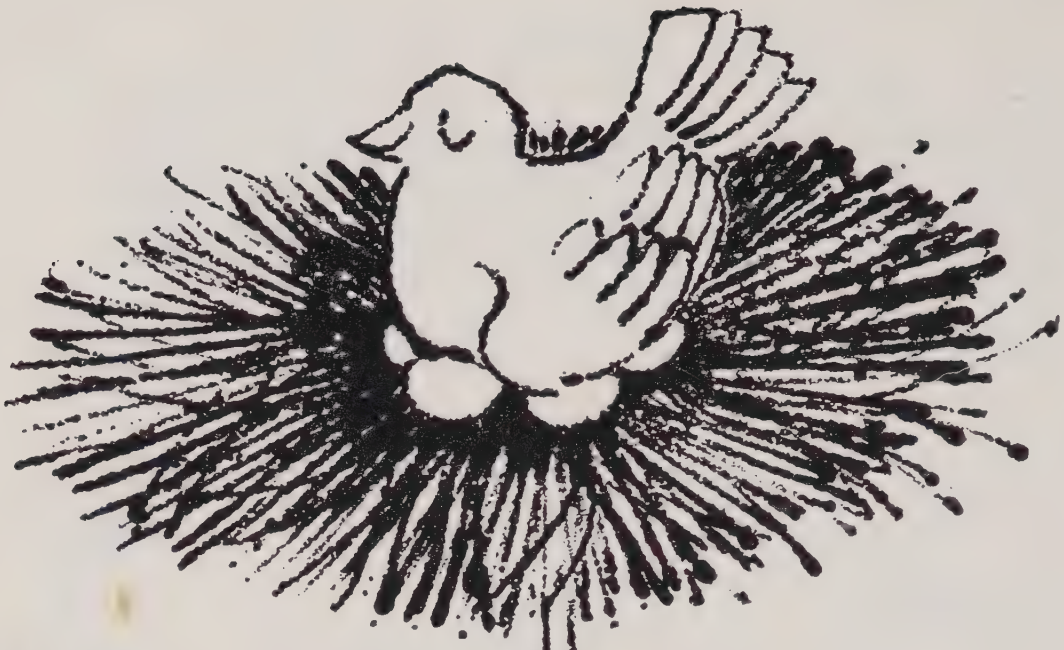
*DATE* Tuesday to Friday, 9 to 12 October.

*HOTELS* Early reservation is suggested. A note on recommended hotels in the vicinity of the Royal Hall will be sent on request.

*EXHIBITION* The scope of the Society's Exhibition has been made more explicit by naming it

**THE CLEAN AIR, FUEL EFFICIENCY AND DOMESTIC HEATING EXHIBITION**

(*Stop Press: Two-thirds of the Exhibition space was booked within five days of the issue of details.*)



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## THE FUTURE IS ELECTRIC

# SMOKELESS AIR

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*Ships, towers, domes, theatres and temples lie*
*Open unto the fields, and to the sky;*
*All bright and glittering in the smokeless air.*

# SMOKELESS AIR

## *Thank you, Mr. Brooke*

THE Minister of Housing and Local Government is the Minister in charge, so to speak, of the Clean Air Act, and under the Act he is also chairman of the Clean Air Council. A change of Minister is therefore a matter of importance to the clean air campaign. We should like to express our good wishes to Mr. Henry Brooke on his transfer to another office and at the same time take the opportunity of recording our appreciation of the personal interest he has shown in clean air and of the determination he has made plain on many occasions to make the Clean Air Act a success. With an indifferent Minister the progress that has been made would have been far less than it is. As far as its own powers have allowed, the Ministry of Housing and Local Government, with Mr. Brooke at the helm, has done a fine job in steering the Act through its first years. Fortunately, clean air is a non-party, or rather all-party, subject, so that we can make this tribute without disturbing anyone's political feelings.

Mr. Brooke's successor might have been someone whose personal interest in clean air was much less, but any fears on this score were dispelled when we heard Dr. Charles Hill make his first public speech as Minister of Housing—which happened to be on clean air. This is reported on another page and speaks for itself. Though naturally, as a new boy, Dr. Hill must have depended very largely on a brief, he spoke with a conviction and understanding that augured well for the future.

## *News of Tomorrow*

Future trends and prospects in the production of heat and power are of interest to everyone, and not least to those concerned with clean air progress. The news that methane, liquefied for transport, is to be shipped from North Africa to augment and cheapen our home-produced coal gas, for instance, may be a matter of considerable importance to the progress of smoke control areas. New and improved designs of gas room heaters are already making an impact on the domestic heating market, and if the price of gas can be reduced this trend should become much more marked, so that, coupled with a growing demand for central or whole-house warming systems, the possible future dangers of a shortage of solid smokeless fuel are bound to become less. This is important when it is remembered that, apart from natural gas, the total gasification of coal, as in the new Lurgi plants, may well become a major feature in the industry, with a corresponding drop in coke or other solid smokeless fuel production. The prospect of cheaper (or relatively cheaper) gas is therefore to be warmly welcomed for the aid it can give to clean air progress. Criticisms have been made that the importation of methane will injure the coal mining industry, but since the methane will be only 10 per cent. of the total gas, it is evident that if the low price promotes even a modest increase in demand the

amount of coal required for carbonization or gasification may well go up instead of down.

Another development that may be of importance to clean air tomorrow is the intensification of research recently announced on the fuel cell. This is a method for converting a combustion or chemical process directly into electricity, and which in theory could give nearly 100 per cent. efficiency. From the clean air viewpoint it would seem to have two important aspects: the amount of fuel would be relatively small, and if hydrogen and oxygen are used the only effluent would be water vapour; and secondly, compact, high-power fuel cells might greatly improve the economics and convenience of electric traction on the roads.

Power production without combustion is the ideal for completely clean air, and another probe into the future is the suggestion that instead of a Channel tunnel or bridge there should be a dam across the Channel. It would have a roadway on top and would use the surge of the tides for the generation of electricity. In theory a vast amount of power is available, and it is claimed that the construction techniques are known from the achievements of the Dutch. Maybe there are too many snags, but the idea has its appeal, and we hope that it is carefully studied before either the bridge or the tunnel wins the day.

## *Reluctant Authorities*

A local authority correspondent has put a problem to us that can be stated thus: In a group of local authorities that in effect are a single area of pollution there may be one or more that are dragging behind their neighbours in smoke control area progress. What can be done to bring the laggards up to scratch, and could the Minister do anything?

Since the creation of smoke control areas is explicitly permissive the Minister clearly cannot require action to be taken, nor could he be expected to act as a kind of hidden persuader in such matters. Surely the answer is that the active authorities should themselves do the persuading or prodding, possibly by the formation of a joint committee for clean air, and for this committee among other things to build up a case for concerted action. The laggards would of course be invited to join, in such a way that refusal would be difficult, and then with patience their reluctance could be worn down. Or is this too simple a suggestion, and is there a better answer? We should be glad to have the views—or experiences—of local authority readers.

## *Two Forward Moves*

We are glad to record, on other pages, two important steps towards the fuller implementation of the Clean Air Act. There is the publication of the British Standard for simplified methods for measuring grit and dust in flue gases—a preliminary, we expect, to the regulations under section 7 of the Act, which are the pieces so far missing. This section, it will be recalled, applies only to furnaces burning pulverized fuel or burning one ton per hour of any other solid fuel. Those who have read Mr. J. W. Batey's paper to the Brighton Conference will have noted that in Sheffield a survey had shown that only two furnaces approached the one ton per hour limit. Mr. Batey's view was that there will be no major improvement in grit emissions until the one ton per hour is divided by ten and brought down to two hundredweights. If Sheffield's installations are typical there certainly seems to be a case for review, although unfortunately the figures are written into the Act itself.

The second forward step is the agreement that has at last been reached for the replacement in smoke control areas of miners' concessionary coal by smokeless fuel, or if this is not available, by cash payments. This question of miners' coal has been very difficult indeed, and has been holding up the establishment of smoke control areas in many towns that will benefit greatly

from them. We hope that this change, which to many miners and their wives will be a major change, proceeds smoothly and without friction. But the local authorities will clearly have to proceed with special care and understanding. We trust that the N.C.B. and the Unions concerned will co-operate to the full in showing why smoke control is so desirable.

## *Answering Back*

The Warwickshire Clean Air Council—one of the advisory regional councils of local authorities—has made an appointment to which we would like to draw the attention of other similar bodies, and indeed to the Society's own Divisions. This is what is in effect a Press Officer, to be concerned with watching the local newspapers and replying, or seeing that a reply is sent, to any correspondence or reports attacking or denigrating clean air policies. Such adverse publicity, often inspired, is frequent and may be harmful (even though it is sometimes very silly) unless it is answered vigorously and promptly. The Society has offered to give any assistance or information that may be required. We do of course answer Press letters ourselves, but we are up against two impediments: the unavoidable delay in receiving cuttings from an agency, and the difficulty, with so small a staff, of always finding time to draft and send off a reply without further delay. Nevertheless we shall do all we can to assist any more "Press Officers" who may be appointed, as we hope they may be.

## *Staff Changes*

During the last few months two members of the Society's staff, known to many members, have left us. Mr. L. Nevard, Administrative Secretary, has become a Lecturer at the Slough College of Further Education, and Mr. H. C. F. Kapps, Information Officer, has also moved into the teaching world, to a school in Dorset. We would like to record our appreciation to them both on their valuable services to the Society, and to wish them well in their new fields of work. Mrs. V. Finlay, M.A.(Oxon.) has been appointed as Information Officer—a post that includes those of Librarian and Press Officer—and was with us for the busy time before and at Brighton. The new Administrative Secretary will be, from the New Year, Mr. Roy Sharp. In addition to being a certified secretary and an A.C.C.S., Mr. Sharp is an experienced journalist and is at present Features Editor of a well-known technical monthly. He will thus be able to act as deputy editor for the Society's publications. The absence of an "Admin. Sec." from the Society's small staff has naturally led to some slowdowns in the flow of work at headquarters, but *Smokeless Air* at least, has been produced to schedule.

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# CONCESSIONARY COAL AGREEMENT

It is announced that agreement has been reached between the National Coal Board, the National Union of Miners, and the Overmen, Deputies and Shotfirers' Association on the question of replacement of concessionary coal by smokeless fuels in smoke control areas. The negotiations have been in progress for a considerable time.

Under the agreement the coal will be replaced by smokeless fuel, mainly coke, to a value of £42 7s. a year for householders and £28 2s. a year for sub-tenants. The N.C.B. has said that in cases where smokeless fuel is not available, cash payments, in most cases tax free, will be made.

The agreement will mainly affect miners in Yorkshire, Lancashire, the West Midlands, Northumberland, East Midlands and Scotland. It is expected that a similar scheme for men in the Board's coke works will be ratified in the near future.

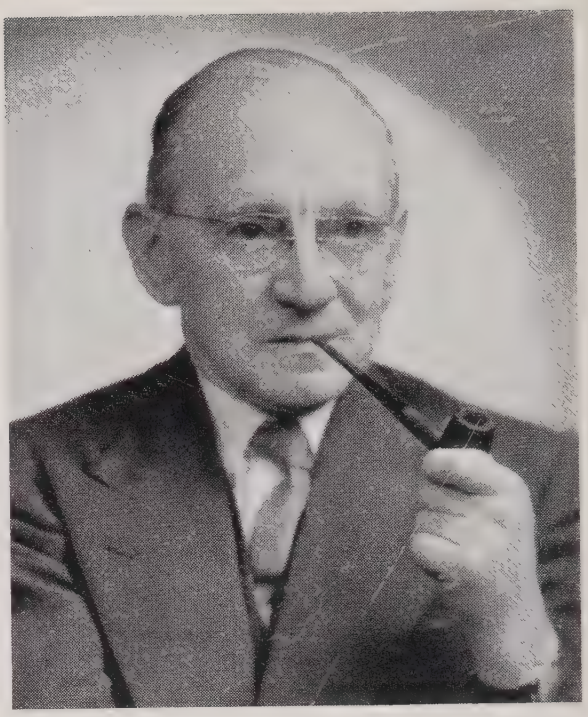
# T. P. COLCLOUGH

It is with regret that we have to record the death, on September 22nd, 1961, of Dr. Tom Peach Colclough, C.B.E., a member of the Society's Executive Council and Chairman of its Technical Committee. Dr. Colclough was the representative to the Society of the British Iron and Steel Federation, to which he was Technical Adviser. He was 76.

Dr. Colclough had a distinguished and influential career in the iron and steel industry, which he entered in 1916, after completing his education at the universities of Manchester and Sheffield. Later, he had much to do with the development of Corby, Ebbw Vale, and other steelworks in this country, while his advice was sought for projects in Germany, Austria, Turkey, China and New Zealand. During the last war he was technical adviser to the Iron and Steel Control of the Ministry of Supply, for which service he was appointed a C.B.E. in 1947. In the postwar years, in addition to his work with the Federation in the many developments of the industry in Britain, he travelled much as an adviser or leader of British missions. Thus he was technical adviser to the British consortium that built the Durgapur works in India, and was a member of the Royal Commission on the steel industry of Southern Rhodesia.

In addition to these activities he continued to be closely concerned with research and in particular with the work of the British Iron and Steel Research Association. Among other honours he was awarded the D.Met. of Sheffield University in 1959.

He still had time for a close interest in the work and progress of the N.S.C.A., in which he was a valuable and alert member of the Council, and a wise committee member, never playing a merely passive part. Sometimes he would create an impression of being difficult, when he was in fact making sure that whatever problem was being discussed would be given a clearer examination and analysis. As chairman of a meeting or conference—as at a special meeting convened by the Society a few years ago at Nottingham for local authorities with iron and steel works and representatives of the industry—he could lead and control a discussion with a rare skill, hidden though it might be by a delightful geniality and infectious good humour. He was a man of distinction, held in warm respect and affection by all who knew him.



*Dr. T. P. Colclough*

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**Smoke Control Area Offences**

Four householders from one of Smethwick's smoke control areas, summoned on November 6th for permitting smoke to be emitted from domestic chimneys, were given an absolute discharge by the magistrates—because they were the first to be so summoned.

"But," the magistrates warned, "we don't want people living in those particular areas to think that they will be allowed to get away with it as easily as you have done. Any other cases brought before the court will be dealt with in their proper perspective and fined accordingly."

*Brighton Conference*

# *Presidential Address*

*by*

**The Rt. Hon. Lord Cohen,**
**P.R.S.H., M.D., D.Sc., LL.D., F.R.C.P.**

MY first words must be of warm gratitude for the enviable privilege and signal honour of being elected President of this Society. The honour is enhanced for me because my predecessor is Sir Hugh Beaver. His occupancy of the Presidential Chair is a measure of its prestige, for when the history of Government action in trying to stem the evil effects of atmospheric pollution is recorded, to no name will higher tribute be paid than his. It was the Report of the Committee on Air Pollution which he chaired, which alerted the country to the widespread evils which flow from atmospheric contaminants, and which removed the idea of " Clean Air " from the realm of eccentricity, fad and obsession, to become a National goal.

To elect a physician as your President is to recognize the grave consequences to health of atmospheric pollution. There are many definitions of health, and not one is wholly satisfying to anybody but him who drafts it. Yet for practical purposes, I commend that of the World Health Organization, namely, " a state of complete physical, mental and social wellbeing, and not merely the absence of disease or deformity."

This definition makes us aware of the complexity of the problem of atmospheric pollution. Physical wellbeing must take account of man's comfort. Thus arises a vicious circle. Man's search for comfort and pleasure has poisoned the air we breathe. At first the fumes from his log and peat fires which warmed him, and then from coal, which even in the 13th century were recognized as prejudicial to health. Soon industry was indicted. In 1627 Charles I asked the Royal College of Physicians of London to investigate a complaint about the alum works in Aldgate, its " loathsome " vapour annoying the inhabitants within the radius of a mile, and also it was alleged that it tainted the pasture and poisoned the fish in the Thames. The Royal College of Physicians' Committee, which on investigation found the complaint justified, included in its membership the famous William Harvey, discoverer of the circulation of the blood.

In 1661, was published John Evelyn's *Fumifugium*, and our Society is to be warmly congratulated on its tercentenary reprint of this classical text. In it Evelyn deplores with just and unrestrained indignation that the " Glorious and Antient City " of London " should wrap her stately head in Clowds of Smoake and Sulphur, so full of Stink and Darknesse."

With the 18th and 19th centuries came more furnaces, factories and steam-engines, and also an increasing density of urban populations exposed to the smoke polluted air. The 20th century saw in addition the fouling of air with the exhaust gases of automobiles, and then as man's scientific genius reached a crowning peak in unmasking Nature's secrets, we used the knowledge of the atom to blast into the sky the mushroom cloud of the atomic bomb, and so gave birth to a pollutant which could not only destroy man, but, if he survived its onslaught, could condemn his offspring.

It is in retrospect puzzling that only sporadic and half hearted efforts were made by Governments to deal with the effects of increasing air pollution. The long struggle of this Society for the recognition of the importance of Clean

Air reflects the difficulties which reform encounters, but it is heartening to record that when this Society held its first post-War Conference in Brighton in 1946 all previous attendance records were broken, even though that Conference was less than half the size of that now assembled.

It is true that certain episodes made a forceful impact on public opinion, but Governments paid little heed to these isolated incidents (though there were at least five in London in the last quarter of the 19th century with a striking number of deaths) and voluntary effort had no wide support.

Two episodes, one in the U.S.A., and the other in London, were to transform the public's attitude, and to spur Governments to action.

The first took place during the last week of October, 1948 in the city of Donora, some 30 miles south of Pittsburgh, and the seat of a large steel industry and zinc reduction plant. Fog developed on the morning of the 27th October, and with it an accumulation of atmospheric contaminants. Four days later rain cleared the air, but in those four days there were seventeen deaths as against the normal expectation in that period of two; 5,910 persons (42.7 per cent of the population) were affected by varying degrees of cough, irritation of the eyes, nose and throat, breathlessness and vomiting; in a quarter of the population the symptoms were severe. Over 60 per cent of the affected were 65 years of age or over. The importance of this episode lies in the fact that the United States Public Health Authorities were invited to assist in making an intensive epidemiological survey in which meteorologists, physicians, chemists, fuel engineers and others all co-operated. This was indeed the initiation of the extensive research programme in this field which is now being undertaken in the U.S.A. The second, and much more tragic episode, occurred in London between the 5th and 9th December, 1952. Its features are too well known to need repetition except to remind you that of its toll of 4,000 deaths, although all ages suffered, the main victims were the old, especially those suffering from chronic bronchitis and chronic heart disease. As in the Donora episode $SO_2$ seemed the chief offender. There was six times the average amount of $SO_2$ in the air, and it was estimated that 60 per cent of this was due to domestic fires.

It was this tragic event which led to the appointment of the Beaver Committee; it was the Report of that Committee which made our own Government aware of its responsibilities for Clean Air, and it led to the Clean Air Act of 1956.

It is not, however, these dramatic acute incidents which are the main concern of the physician. The questions which he must attempt to answer are " what is the effect on health of prolonged exposure to small amounts of air pollutants? " " What part do they play in the causation of chronic disease, or in rendering a person more liable to acute disease? " Here let me interpolate a warning against a too simple conception of cause in disease. We know that the tubercle bacillus is a *necessary* cause of pulmonary tuberculosis. Yet it is not the *only* cause. Crowding, malnutrition, lack of fresh air—all play a part in increasing our susceptibility to infection with the tubercle bacillus. These are therefore, *non-specific predisposing or contributory causes*. And so, in assessing the effects of air pollution we must bear in mind the diseases to which it renders us less resistant, and not simply the diseases due to a specific pollutant, e.g. the fumes of arsenic.

In considering this problem we must appraise carefully the available facts and not be oppressed by theory. For example, it is a fact that a heavy cigarette smoker is several times more likely to develop cancer of the bronchus than the non-smoker, and the prudent man will heed this fact and not reject it if a theory which seeks to explain this relationship is proved invalid. Though we search strenuously for the specific offending pollutants in the air we do not need to know them to show

that polluted air of undefined composition is injurious. A century ago John Snow knew that polluted drinking water could cause cholera, though many years were to pass before the causative organism of this disease was discovered.

Physicians have long been concerned with the effects of air on disease. One of the earliest Greek medical texts, written 2,300 years ago, is Hippocrates' *Airs, Waters and Places*. And the name " malaria " or " bad air ", introduced by Francesco Torti in the early 18th century, concealed what we were to learn in this century, that the bad air arose from swamps in which flourished the female mosquito larvae which in adult form carried the malarial parasite from man to man. The doctrine of *Miasmas*—disease due to the noxious exhalations or vapours arising from putrefaction of organic material—was the explanation of the infectious fevers in the 18th century; and alterations in barometric pressure played, according to Mead and his contemporaries in the 18th century, an important role in the genesis of both physical and mental disease.

With the development of scientific medicine and the discovery that man breathes oxygen, nitrogen, carbon dioxide and many inert gases in small amounts, came the recognition of the inevitable pollutants.

Of these pollutants some occur naturally and others are man-made. The natural pollutants include pollen (which is responsible for much discomfort and disease in the form of hay fever and asthma), decay of organic material, volcanic dusts and even dusts from outside the earth's atmosphere.

But it is the man-made pollutants which in today's context concern the physician. Their effects on man may be toxic or irritant, or they may be responsible for allergies. They can, of course, affect man indirectly by their toxic effects on animals or plants which provide his food; they can increase his liability to accidents because polluted air impairs visibility; they can interfere with his aesthetic pleasure when objects of architectural beauty are discoloured or blighted, and even the economic consequence of damage by pollutants may play a part in the development in man of anxiety states.

I have already exemplified the dramatic effect of sudden exposure of a community to an excessive degree of atmospheric pollution. The effect of more prolonged exposure to smaller amounts of pollutants has been less intensively studied until recent years except in regard to, firstly, the creation of a highly individual and personal pollution with cigarette smoke with its resultant chronic bronchitis, bronchial cancer and chronic heart disease, (though the cigarette smoker can render an enclosed space, such as a railway carriage, public room, theatre or concert hall, intolerable to the chronic bronchitic or asthmatic); and secondly, the pollution associated with industrial processes which increase the atmospheric content of hydrochloric acid, arsenic, fluorine, beryllium, lead and dusts responsible for pneumonoconiosis, *e.g.* silicosis, asbestosis, byssinosis, bagassosis, etc.

These occupational diseases have attracted research into preventive measures, and many have been devised and some made statutory. But the problems of air pollution in industry and in the community are not strictly comparable. In industries a specific pollution can be indicted; in community pollution there are many non-specific pollutants such as dust, smoke, $SO_2$ $NO_2$, ozone, carbon monoxide, hydrocarbons, etc., which are derived from coal fires, industrial furnaces, automobile exhausts, and the like. Again the worker is exposed intermittently to the pollutants, say for eight hours a day, and is usually a healthy person, whereas community exposure is for twenty-four hours a day with no remission, and it affects all ages.

It is, however, important to remember that industrial specific pollutants may escape and affect those living in the neighbourhood of a plant, but not connected with it; for example, beryllium which produces a clearly

recognized lung condition (chronic pulmonary granulomatosis), chronic carbon monoxide poisoning near gasworks, and very rarely cases of chronic manganese and chronic fluorine poisoning have been described in which the pollutant appears to have originated in a neighbouring factory. Many industries add to the community air load of allergens. These include baking, cotton milling, processing fur, jute, feathers and hair; manufacture of felt hats, carpets, leather, soap, furniture, tobacco, and even castor oil, whose extraction from the castor bean frees a powdery material which is highly allergic. These form admittedly quite a small part of the problem of allergy, except for those actually exposed in industry. Most of the atmospheric allergens are naturally occurring, *e.g.* pollens, and are thus less controllable.

Our knowledge of the relation of chronic disease to atmospheric pollution in Great Britain is largely derived from epidemiological and statistical evidence, for the subject as yet lends itself with difficulty to experimental study. Yet there are no richer opportunities for such epidemiological studies than in Great Britain where over one million tons of smoke are still emitted yearly from domestic fires, half a million tons from industry, and 100,000 tons from our railways. Domestic chimneys are responsible for 100,000 tons of grit and dust out of a total of 900,000 tons belched yearly into the atmosphere; and of the five and a half million tons of $SO_2$ emitted, domestic fires contribute nearly one million tons. It is not surprising that the inhalation of this filth and poison should affect the respiratory tract, as is seen in chronic bronchitis with its cough, expectoration, breathlessness and heart strain; the high incidence of this disease in this country has earned it the eponym of " the English disease ". The death rate from chronic bronchitis in England and Wales in males is about fifty times higher than in Denmark, and about twenty times higher than in Norway and Sweden. Not only are the deaths from chronic bronchitis rising (in 1954, there were 25,780, and in 1959, 29,051) but this disease is responsible for 10 per cent of all industrial absenteeism amounting to over twenty-five million working days. It has been long recognized that chronic bronchitis occurs more frequently in towns than in country areas, and that it is closely related to the density of population. A convincing demonstration of the relation between pollution and bronchitis was provided by the study in this country by Fairbairn and Reid in 1958, who investigated sickness amongst postmen. In 37 towns they found wide variations in the rates of absence from work due to this disease, but these were strikingly correlated with the indices of air pollution based on the frequency of fog in these towns. No part was played by social, economic or other climatic factors. But not only was the frequency of chronic bronchitis related to pollution, the character of the disease varied also. Minor infections in younger bronchitics appear to be independent of the degree of pollution. It is the older chronic bronchitic postman in polluted areas in whom these minor infections lead to more frequent absence from work, and seem more often to lead on to such complications as pleurisy, pneumonia, and circulatory failure, which hasten death. When this effect on the older populace is considered, we should recall that our population is an ageing one, and in the years to come, even if pollution does not increase, the increasing age of our population will result in more widespread disease and disability.

Many other investigators, both before and since, have confirmed this study of the association between pollution and chronic bronchitis. A recent paper by A. E. Martin (1961) is worth noting. He quoted P. J. Lawther who found that the subjective feelings of the patient were the most sensitive indices of morbidity. He asked patients to keep diaries recording their general condition and whether they were " better than ",

" the same as ", or " worse than " the day before. Using this method he found the degree of illness was closely related to atmospheric pollution, as shown by daily measurements of smoke and $SO_2$. An important fact showing that the patients were not unduly influenced by the appearance of the weather was that periods of low visibility did not always correspond with a deterioration in the condition of the group.

Another recent important study by Boyd (1960) analysed data from the City of London for seven consecutive winters, concerning the weekly total deaths from various respiratory and cardiac conditions, and weekly indices of smoke pollution, atmospheric $SO_2$, mean daily minimum temperatures, vapour pressure and visibility. The temperature, humidity and visibility indices were found to have no significant effect on deaths from lung or heart disease, but there was a close relation with the amount of pollution due to smoke and $SO_2$.

Another worthwhile investigation is that of Dr. Percy Stocks (1960) whose studies showed that the incidence of lung cancer was strongly correlated with smoke density in the North of England, and a similar though weaker correlation was found within Greater London. Bronchitis and pneumonia in men, and bronchitis in women showed similar strong correlations with smoke pollution. An interesting finding was that cancer of the stomach and intestines are related significantly with smoke in the thirty County Boroughs which were investigated, whilst cancer of the breast in women shows no such relationship. Analysis of the smoke showed that for lung cancer and bronchitis, 3 : 4 benzopyrene was the predominantly guilty compound, though it had little effect on pneumonia. Stocks' analysis of trace elements showed that for lung cancer beryllium and molybdenum were most closely correlated, though for bronchitis the correlation was stronger for molybdenum. Here again, female breast cancer showed no relationship with trace elements.

It must be conceded that correlation tests indicate simply a mathematical association and not necessarily cause and effect. Conclusions from such studies must, therefore, be drawn with care and restraint, but when a whole corpus of results from many varied sources admit of only one interpretation, it is sheer folly to neglect their implications.

We must, nevertheless, seek additional evidence. All recent studies have been retrospective, *i.e.* patients suffering from disease have been questioned about their past history. Such recollections are fallible and occasionally misleading; also we cannot with certainty exclude from past history the effects due to pollution, associated weather conditions such as frost or snow, and concomitant epidemics, for example, of influenza. More helpful and less vulnerable evidence will be given by forward looking or prospective studies in which a group of individuals whose health has been defined initially, and whose respiratory symptoms, such as cough, sputum production, breathlessness, can be studied at regular intervals in the future. The difficulties of such an investigation are formidable, but they have to be faced, and the Medical Research Council has begun such a study on Transport and Post Office workers in London. Quick results cannot, however, be expected. All the evidence suggests, that long exposure to small amounts of pollution is needed before the effects are seen and felt.

Unfortunately, animal experiment in this field is of little value, and experiments on human beings are unthinkable except for one. We can watch with care the effects of the Clean Air Act, of removing smoke and offending pollutants from the atmosphere of our cities. If what we believe is valid, then we can expect in smokeless zones a reduction in the incidence of chronic bronchitis, bronchial cancer, and other diseases in which air pollution is a contributory cause, provided, and it is an important reservation, that two other highly

relevant factors—namely, cigarette smoking and automobile exhaust gases, do not gain so much in strength that they offset the benefit of air cleansed from other pollutants.

I do not propose to add to what I have said in many other speeches on the relationship of cigarette smoking and cancer. But I must say a few words on the pollution by automobile exhausts which is an increasing and urgent problem of our major cities. We have not yet experienced the eye-irritating pall which blots out the sun, as in Los Angeles, where three million cars burn five million gallons of petrol daily, and which has inspired so much engineering research on methods of control. In this country, however, the exhaust from automobiles is now aggravated by that from diesel-oil propelled vehicles. It is true that there is, as yet, no secure evidence that smoke and fumes from this source are detrimental to health, but there are adequate reasons for abating the nuisance; it creates dirt and gives rise in other road users to danger, annoyance and frustration. Coasting behind a vehicle belching dark and irritating smoke from its exhaust may contribute not a little to the impatience and resulting faulty judgment which lead to taking unwarranted chances in overtaking, and may thus cause many a road accident.

We are not yet confronted seriously by the problems of radiation hazards, though some areas have been exposed to radioactive pollution from effluents from nuclear reactors, from nuclear chemical processing plants, from radiochemical laboratories, and hospital incinerators, and from the as yet apparently harmless " fall out " from nuclear weapon testing. But recent history suggests that the chronic effects of radiation, such as those giving leukaemia and cancer, infertility, premature ageing, and genetically determined deformities, might become a major problem even if we are spared a nuclear holocaust.

I fear that I have traversed superficially a wide field, and I have left untouched many of the varied problems of pollution in fields other than health. But are we not justified for health reasons alone in proceeding with the implementation of the Clean Air Act, with much greater speed? Why is there such opposition and delaying tactics to this splendidly worthwhile social enactment, when it could yield such dividends and lessen illness, death and human misery, diminish medical costs and absenteeism, increase productivity and significantly decrease our expenditure on artificial illumination, on the repair and renovation of buildings, on damage to crops and to animal welfare, and improve our fuel resources?

A few figures will clearly show the economic advantages of control in these fields. In France, for example, a study made in 1957, revealed that additional expenditure due to pollution on cleaning and provision of clothes, on repairing houses, on building maintenance, in reduction of earnings, and cost of medical services totalled £160 million. In this country one ton of smoke causes over £20 worth of damage, that is, each ton of coal we burn dissipates 7s. 6d. needlessly. Living in the country as opposed to the city saves over 50 per cent in laundering, and increases the life of clothes. Increasing pollution in the past few years has decreased the life of zinc work from 30 years to, in the worst areas, 4-5 years.

Clearly we cannot expect to eliminate all sources of pollution. Manufacturing processes must continue, and cars must be driven, but we can make a much weightier contribution than at present by using to the full current knowledge of pollution control, and by carefully planning and siting all factories and houses; also we must pursue research more intensively and bring to the solution of pollution problems all relevant disciplines. We need, for example, to know more about the best design of fire equipment in factories, about measures for preventing combustion of the culpable fuels, etc. In the automobile field, for example, much

experimental progress has been made with catalytic combustion devices in exhaust pipes, so that unburnt hydrocarbons can be reduced by 92 per cent by conversion to carbon dioxide, and by similar conversion we can eliminate 75 per cent of the excess of carbon monoxide. Again, carburettor adjustment and possible injection of water could reduce by 90 per cent the emission of nitrogen oxides (Drinker 1961). Novel and less harmful forms of motive power which are now available experimentally may play an important part in future control.

We cannot brook delay. Our present knowledge if applied could do much to cleanse the air we breathe.

One of the most pressing problems of this Society is to persuade and educate authorities to face their responsibility and to help them with their problems. We should remind them, to quote from the Beaver Report, that proposals for abating air pollution " if carried out will secure happier and more healthy living conditions for millions of people and that on all counts the cost and cure will be far less than the national loss in allowing the evil to continue ". And even if there is considerable expenditure needed did not John Webster have the heart of the matter when he wrote three and a half centuries ago that " Gold that buys health can never be ill-spent ".

We must press when needs be for additional legislation whatever the opposition or obstruction, however dire the prophecies of commercial ruin, however clamant the voices raised in protest against a so-called loss of individual liberty, for these too often give no thought to the welfare of others.

The tasks of this Society are indeed onerous, but so is the burden shared by all who seek to promote social and health reform. But we must be resolute, and in our resolution recall Disraeli's dictum that, " The health of the people is really the foundation upon which their happiness and all their power as a state depend ". Then we can with confidence sustain our burden and our cause.

It is, indeed, because I admire so warmly the past achievements of this Society and have unbounded faith in its capacity to further the welfare of the citizens of this land, that I feel so honoured by occupying its Presidential Chair.

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A symposium. " The Air Over Cities " was held at the Robert A. Taft Engineering Centre, Cincinnati, U.S. Public Health Service, on November 6th and 7th. The twenty papers listed in the programme were divided into three groups: weather, climate and air pollution in cities; the dispersion and deposition of air pollutants over cities; and present and future needs for meteorological and air quality observation.

# *Address to the Brighton Conference*

by

**John C. George, C.B.E., M.P.**

*Parliamentary Secretary, Ministry of Power*

IT is a great privilege for me to be present today to open the Conference and the Clean Air Exhibition. I should like to start with a statement of the problem—not mine, and not new!

"It is this horrid Smoake which obscures our Churches, and makes our Palaces look old, which fouls our Clothes, and corrupts the Waters, so as the Very Rain, and refreshing Dews which fall in the several Seasons, precipitate this impure vapour, which, with its black and tenacious quality, spots and contaminates whatever is exposed to it."

This is not a quotation from an unknown play of Shakespeare, or one of Winston Churchill's wartime speeches. This is, in fact, the measured language of a Command Paper entitled "Fumifugium." It is true that the Command was given 300 years ago by his Sacred Majesty King Charles II, and that the author was that John Evelyn, the Father of Clean Air, who was the spiritual predecessor of your distinguished Immediate Past President, Sir Hugh Beaver. I congratulate the National Society for Clean Air on their initiative in again re-publishing this classic work, on the tercentenary of its first appearance.

John Evelyn was, of course, far ahead of his time in seeing the problem so clearly; since then, the problem has increased both in scope and intensity, tormenting wide areas of the country.

The "Black areas" are no credit to our sense of social well-being, nor indeed to our intelligence. I believe, that partly due to the helpful publicity that we have had on clean air—for much of which the Society has been responsible—the nation is alive to the fact that smoke is a menace to health and happiness, and can no longer be tolerated.



*John C. George, C.B.E., M.P.*

We have clean food and clean water; the country, I believe, is now determined to have clean air, and will not long tolerate opposition or dilatoriness in its achievement. That is why we are here now, and the Government welcomes your keen interest.

In the Clean Air Act, Parliament has given us the legislative tools for the job. Within the Government, the

main responsibility for clean air lies with the Minister of Housing and Local Government, who devotes immense energy to this task. He maintains constant contact with the local authorities.

The Minister of Power also has important interests. First, he is concerned to see that adequate supplies of suitable smokeless fuels are available to ensure the speedy implementation of the Act. Secondly, he has a major interest in promoting fuel efficiency—although the pressure on our fuel resources has eased in recent years, it would be folly to waste fuel—as we did so wantonly for so long. Fortunately, fuel efficiency and smoke reduction go hand in hand.

It is specially gratifying for me to take part in today's proceedings, firstly, because I was a local authority delegate to the Society for some years, and secondly, since becoming Parliamentary Secretary, I have been closely involved in furthering the Government's clean air policy.

The main forum in England and Wales is the Clean Air Council and I serve on this as Vice-Chairman under Mr. Henry Brooke's chairmanship; I also, incidentally, keep an eye on the fuel aspects of the work of its Scottish counterpart.

Moreover, I have recently been asked to chair the Ministry of Power's National Advisory Committee on Solid Smokeless Fuels, which gives the Minister the authoritative advice of producers and distributors on all the various problems of smokeless fuel supply and demand. All this gives me a vested interest in the continued success of your efforts.

It is now five years since the Clean Air Act was passed, and the Act in its entirety has been in operation for more than three years. It is, therefore, a suitable time to look at the progress made so far, and to consider future prospects.

**What Progress?**

The basic question, of course, is—What progress can be recorded? Is clean air being achieved as fast as it should be?

The present programmes of the local authorities in England and Wales cover about six million premises in black areas, but at this moment only about 800 thousand of these premises have been covered by Smoke Control schemes; and it will be some time before all these are approved by the Minister and come into full operation.

The rate of progress has unfortunately been somewhat slower than that envisaged by the local authorities in their programmes published last year (Smoke Control, Cmd. 1113); they then expected that in 1959 and 1960 alone, they would be initiating schemes covering altogether 700,000 premises, but in fact only about half a million premises were covered. While clearly a useful start has been made we must hope for quicker progress in the future.

One disturbing feature is that, of the 294 English authorities whose areas are included in the provisional list of black areas, 73 have still not submitted programmes for making Smoke Control Orders.

I have heard two main reasons given for delays:

(1) doubts about the availability of smokeless fuels,

(2) the difficulties in overcoming the problem of miners' concessionary coal.

For reasons I shall develop in a moment, I do not think that fears about smokeless fuel supplies need now deter any black area from taking action against domestic smoke. Similarly, the indications are that the problem of buying back miners' concessionary coal is nearing a solution; and it, too, need no longer deter any local authority from acting.

The Government, therefore, hope that black area authorities in England who have not yet submitted a smoke control programme will now do so as a matter of urgency.

To help in accelerating progress generally, the Minister of Housing and Local Government has virtually abolished the so-called " provisional

clearance" stage in the making of smoke control Orders.

I understand, that to reduce the burden of work on the staff of local authorities, and to speed progress with smoke control, the Minister is now seeking to streamline procedures further. He has in mind to ask local authorities for less elaborate financial returns; it may be that this will enable many local authorities, if they so wish, to abolish comprehensive door to door surveys in prospective smoke control areas. The local authority associations have been asked for their views on this proposal.

Meanwhile, we must rely on the local authorities and the weight of public opinion to advance the pace of clean air: and this is a field in which I feel that the Society for Clean Air—which has done so much already—can still make an important contribution.

**Smokeless Fuel Supplies**

As I indicated earlier, we in the Ministry of Power are principally concerned to see that adequate supplies of smokeless fuels are available when and where required for the clean air programme. The quantities involved at present are relatively very small—total domestic consumption of all forms of solid fuel is about 40 million tons, of which about one-sixth is smokeless. Clearly, the 350,000 or so premises in smokeless zones which are in full operation at present cannot consume much of that.

As the Clean Air programme advances, demand will undoubtedly increase; but to assess the level of this increased demand, and how it will affect consumption of the different smokeless fuels, involves peering into the murky future, a task made all the more difficult because the air there is far from clear or clean!

What proportion will continue on solid fuel? How many will choose gas, electricity or oil? We are watching closely, but it is yet too early to discern a pattern.

Last year, we had the benefit of the Report of the Peech Committee on Solid Smokeless Fuels, which had been set up to examine future supply prospects in Great Britain, and the adequacy of distribution arrangements. This valuable Report was reassuring generally, in that it confirmed that the overall supply would, so far as could be foreseen, be adequate for the next five years, after taking into account likely progress in smoke control; but it also spotlighted several matters requiring action, including a possible deficit of premium smokeless fuels in 1962, and a possible shortage of open fire smokeless fuels in the Northern Region, mainly affecting the North-east coast.

As the Minister of Power announced in Parliament on May 18th last, the Government welcomed the Committee's recommendations and considerable progress had been made in implementing most of them.

What, then, are the future prospects for the supply of smokeless fuels?

As has long been recognized, we must pin our hopes for some years mainly on good quality open fire coke which can be used satisfactorily in an improved grate: in most areas there is a prospect of adequate supplies of this coke and no local authority need hesitate to rely on supplies coming forward.

The gas industry is producing about one million tons under the trade name "Gloco," which conforms to the new British Standards Specifications for open fire coke, and a further three-quarter million tons of coke of similar quality, but not sold under this trade name.

**Gloco**

This represents a great improvement, but the Clean Air Campaign will not get the full benefit unless consumers are educated to expect neither too much nor too little from Gloco. To expect too much will lead to disappointment and criticism of the fuel: the consumer should not, for instance, try to use it on an *unimproved* grate, and where improved grates are installed, they must have the proper bar spacing.

To expect too little from it will lead to greater demands for other, better, but dearer, fuels, the extra cost of which may not be justified for the householder who has improved grates.

Although some progress has been made in educating the public in the use of Gloco and its capabilities, this inevitably takes time, and there is still a very great educational task ahead. Legally, smoke control areas can be created by Order, in fact, they can only be realities by long and careful preparatory work.

The supply of premium smokeless fuels has also been improved. Perhaps I should explain what I mean by premium fuels. They are the specially reactive solid smokeless fuels that can be burnt in any open grate and do not call for any special appliance. There is, incidentally, an interesting definition in the preface to the edition of Mr. Evelyn's tract which was published in 1772, more than a hundred years after it first appeared.

It speaks of " a method of charring sea-coal, so as to divert it of its smoke, and yet leave it serviceable for many purposes " and it adds prophetically " and premiums should be given to those that were successful in it " (page 40).

Between 1958 and 1960, output had increased by more than one-third from about 810,000 tons to about 1,130,000 tons; output now is at an annual rate of about $1\frac{1}{4}$ million tons.

Moreover, the gas industry has said that it has the capacity to produce greater quantities of premium fuels, and the private producers are expanding their capacity. Looking further ahead, the National Coal Board is making progress with the development of two new smokeless fuels, of which they expect to be producing one million tons a year in 1965, and further expansion thereafter is contemplated.

There should, therefore, be no cause for concern about the overall supply of premium smokeless fuels in the next few years. A high level of demand can be met if desired; but producers must be guided by the markets. Production will follow, and not precede demand.

This again emphasises the need for local authorities to have their programmes on paper. Producers must have some evidence on which to base their development.

During the past few months, the Government has been in touch with producers about the position in the Northern Region. The problem here is that the gas industry produces comparatively little open fire coke, partly because it purchases most of its gas from the coke ovens which produce hard coke suitable only for use in closed appliances.

As a result of our discussions, however, additional supplies of coke can now be made available in this region when needed, and there is no longer any fear that fuel shortages there will bring clean air to an early halt.

The recent decision of the Minister of Housing and Local Government to pay grant on closed stoves should, given the co-operation of local authorities, also help as the hard coke which these appliances prefer is in plentiful supply.

To sum up, the Government is doing what it can to advance the pace of clean air. The Ministry of Housing and Local Government have submitted proposals to the local authority associations for simplifying the procedure for the establishment of smoke control areas, and this should enable the local authorities to go ahead faster in the future than in the past.

We, on our side, are confident that the smokeless fuels will be there when needed. We are also confident that these fuels, properly used, give good value for money spent.

But all this is not enough. You have been crusading for many long years. The crusade must go on, and the need for clean air must be kept continually before the public, and—should I add—before the local authorities? This is where your Society and all those present can play a part of great importance. I know you will not relax your efforts, and I wish you every success and satisfaction.

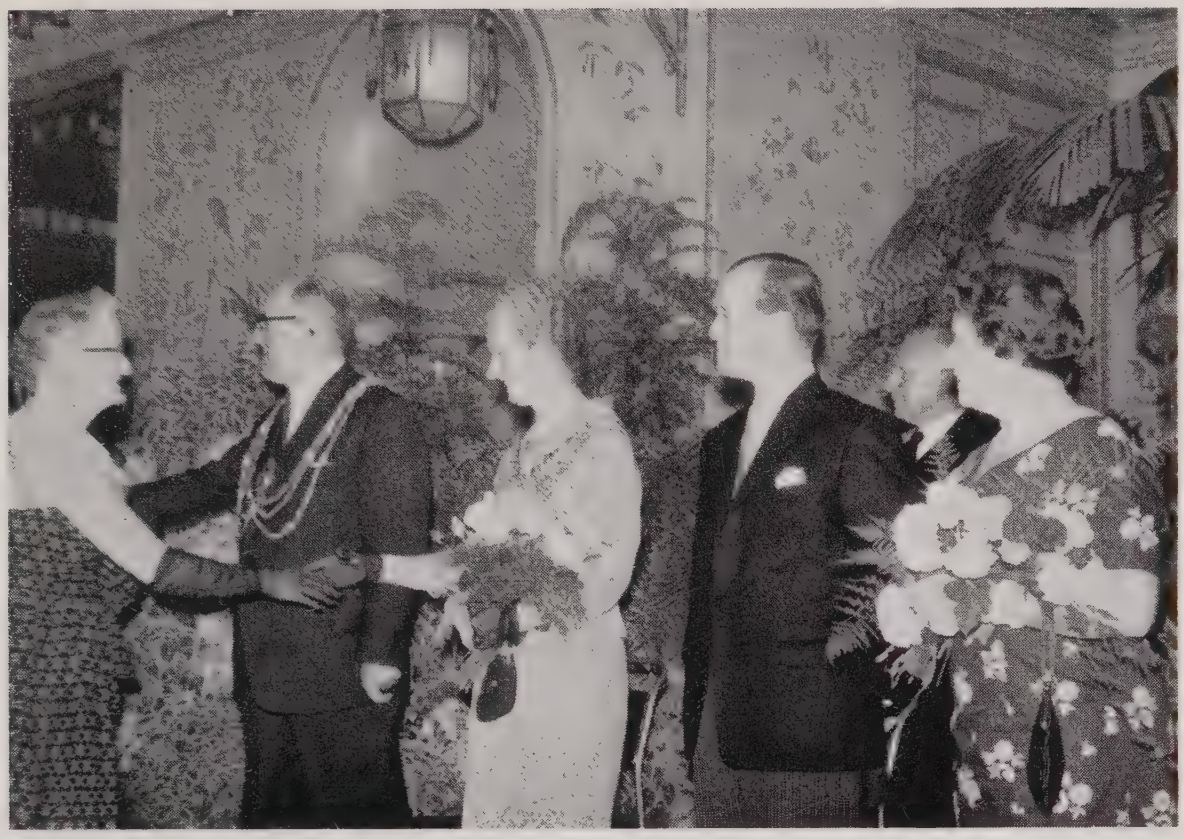
# THE CONFERENCE AT BRIGHTON



*The President addressing the Conference. Right is Mr. John C. George, and on the left are the Mayor of Brighton, Mr. John Innes and Sir Hugh Beaver*

ALTHOUGH they will appear in due course in the *Proceedings*, we are including in this issue two of the most important addresses heard at the Brighton Conference in October, so that they may be read by all our members and other readers. Mr. John George's address on the smokeless fuels situation, coming from the Parliamentary Secretary of the Ministry of Power, is of considerable immediate importance to all concerned with smoke control areas, while the Presidential Address by Lord Cohen of Birkenhead possesses an authority and quality that make it a most valuable addition to the literature on air pollution to human health. Both of these addresses were delivered—after a charming welcome by the Mayor of Brighton, Councillor Baldwin—at the opening session, giving the Conference a flying start towards the success it proved to be.

The other sessions went equally well, the excellence of the papers being matched by a generally high quality of discussion, and all with good attendances despite Brighton's mellow October attractiveness. The new venture, the transatlantic telephone discussion with our American friends in Pittsburgh went off without a hitch; packing a great deal of interesting discussion into a very short space of time, and with the voices of both teams coming over loud and clear to the audience at each end. We must record our thanks to the Air Pollution Control Association of America for their interest and co-operation, and to the Pfizer Group of Companies for so generously sponsoring a feature that otherwise could not be afforded. Nor must we



*Above: At the Reception in the Royal Pavilion. The Mayor and Mayoress of Brighton, Councillor and Mrs. Baldwin, and the Society's Chairman, Mr. John Innes, with Mrs. Innes*



*Right: Dr. J. L. Burn, Deputy Chairman, left, talks with three Netherlands delegates, (l. to r.) Professor J. W. Tesch, Engineer Brasser and Dr. P. Joosting*

fail to mention our appreciation to the G.P.O. engineers and staff for their efficiency and zest in carrying out what to the layman seemed to be a most tricky operation.

It would be invidious to pick out individual papers for special mention, but those who have read them know how well they covered the various aspects of the problem with which they were asked to deal. Those who were present at the Conference will of course receive the volume of *Proceedings*, with all the papers and discussion in full; and we would urge other readers to order copies forthwith. (The price this year will be 15s.) The volume will also include a verbatim report—which makes good reading—of the industrial questions and answers session.

**The Exhibition**

Once again the Exhibition—organized entirely by the Society itself—was a great success. The stands were



*Transatlantic Session—the British team at Brighton. L. to R.—Mr. Marsh, Dr. Lawther, the Mayor, Sir Hugh Beaver, Mr. Goodfellow and Mr. Lister. Behind Sir Hugh, controlling, is Mr. Innes*



*Two of the U.S. team—Dr. Weidlein and Dr. Prindle*

representative of pretty nearly the whole field of clean air activity, and most of them sought to provide displays designed to give interest and information to the specialized membership of the conference. The quality of design was high and the overall appearance of the Exhibition might be described as being in lively good taste. Some of the exhibitors expressed their satisfaction not only in the interest shown in their products but in the better understanding of the needs and problems of clean air they obtained through conversations with delegates and other visitors. Once again we felt that a compact, integrated exhibition such as this, calling only for a modest outlay by the exhibitors, has real advantages over the big, more diffuse shows.

The conference evenings were as full as the days—on the Tuesday the ever-popular informal " get-together," and on the Wednesday and Thursday either the Mayor's Reception in the fabulous



*The U.S. team in action at Pittsburgh. They were being filmed for television reporting*

Royal Pavilion or the clean air film show, with films provided by the exhibitors, in the Dome.

An effort was made to interest and educate the younger generation in clean air, and many parties of school-children and students visited the Exhibition. An essay competition on " A Visit to the Clean Air Exhibition " was organized for them, and we are glad to publish in this issue one of the prize-winning entries, together with some quotations from others.

**1962**

The 1962 Conference and Exhibition, to be held at Harrogate on October 9th to 12th, are already in active preparation. One of the most important conference papers will be by Dr. J. S. Carter, the Chief Inspector of Alkali, etc. Works, on the work of the Alkali Inspectorate since the passing of the Clean Air Act, and progress being made in those sections of industry for which the Inspectorate is responsible.



*At the Royal Pavilion Reception—a good time being had by all!*

# Conference Publicity

*One of the important functions of the Society's Conferences is to provide news about the campaign for clean air and so give it publicity in the Press and on the air. Nearly 500 news cuttings, ranging from an odd inch or two in popular papers to six pages or so in technical journals, have been received, and there were a number of reports on the radio and television. One of the most gratifying reports was that given by Dr. P. J. Lawther on the 7 p.m. Newsreel, Light Programme, on Friday, October 6th. This is what Dr. Lawther said:*

" This Society has been responsible for a revolution in public opinion about the air we breathe. It was natural, that in his Presidential address the distinguished physician, Lord Cohen of Birkenhead, should stress the medical consequences of air pollution. But the subsequent papers ranged over a wide field of interests, and included a description of the national survey of air pollution, the working of the Clean Air Act, and an excellent paper on domestic central heating—smokeless, of course.

" The education of boiler firemen and even examinations for them were again discussed at length. The Society presented its statement on pollution by smoke from diesel vehicles, which has been sent to the Ministry of Transport. It is a calm, constructive document, free from the hysteria which too often attends discussion on this important topic. It makes several concrete common-sense proposals for dealing with this horrible nuisance.

" Then there was a trans-Atlantic telephone discussion with American

(*Concluded on page 125*)




*The Society's own Stand at the Brighton Exhibition*

# PROGRESS WITH GAS

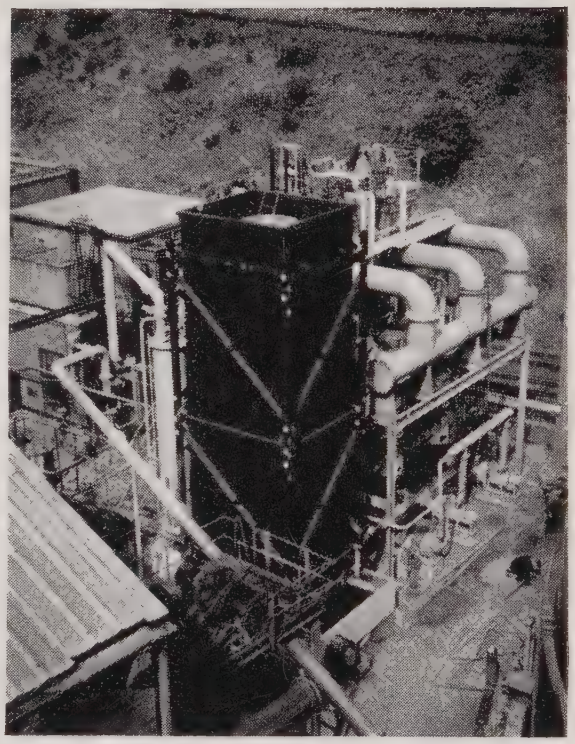
## Report for the Year

**The Gas Council: Annual Report and Accounts, 1961. pp. 180. H.M. Stationery Office, 9s. 6d. net.**

OF the many facts and figures recorded in this report the most notable is that for the year under review the gas industry had a surplus of £2,039,124, compared with a deficit of £2,376,521 in the previous year. Although on the right side of the line the surplus is in no way excessive on a gross income of £401·9 millions.

The number of consumers fell from 12·88 to 12·83 millions, although the amount of gas they consumed rose from 2,591 to 2,665 million therms. About 48·5 per cent. of the sales were to domestic consumers, nearly 32 per cent. to industrial, and over 15 per cent. to commercial users. Sales of warm air units and central heating appliances were about double those of 1959-60, and during the year, 8,000 warm air units and 18,000 central heating appliances were installed.

The report refers to the submission to the Minister of Power proposals for the importation of liquefied natural gas from Algeria. As has now been announced, this has been approved by the Minister. The important developments with the Lurgi gasification process are reported. The first stage of the Scottish Board's Lurgi plant at Westfield, Fife, which completely gasifies the coal used, started operation in December, 1960, and a second Lurgi plant, for the West Midlands Gas Board at Coleshill, near Birmingham, is under construction. The Council and the National Coal Board are jointly studying the possibility of installing large-scale plants of this type, with a capacity of about 100 million cubic feet of gas a day, in the East Midlands coalfield. Research on improving the Lurgi process so that ash may be extracted as slag is proceeding.



*Newly installed plant at the Whitby Gas Works, where natural gas from two wells in Eskdale is reformed to town gas standards*

Although unfortunately the search for natural gas has not yet met with the success enjoyed by some other countries, it is interesting to note that supplies are now being taken by the North-Eastern Gas Board from wells in Eskdale for supply in the Whitby area.

Other exploratory work of great potential importance is into the possibility of storing gas underground in suitable geological structures, for use during the winter peak periods. A site in Hampshire has already yielded promising results and further exploration is continuing in other parts of the country. In connection with this the chemical and bacteriological properties of the soil strata are being investigated to ensure that there would be no contamination of gas stored in them.

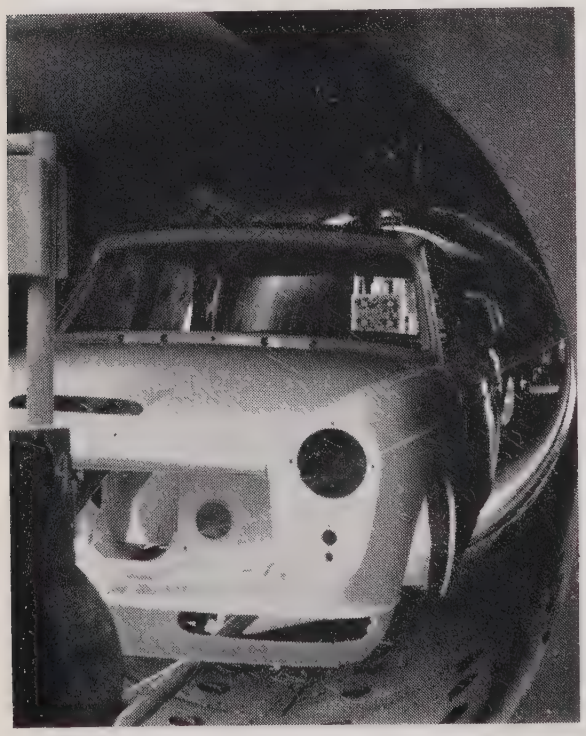
**Research**

The Gas Council has decided to set up a Basic Research Group to investigate new aspects of scientific discovery which might lead to the development of new processes and new methods of application. The group will not be bound by short-term considerations or the need to produce results to a definite programme.

The report describes research work in progress on the production of gas, including pilot-scale work on the complete gasification of coal. This includes the production of lean gas requiring enrichment; the operation of the Lurgi process under slagging conditions, and laboratory work on the gasification of powdered coal in a fluidized bed using steam and oxygen. There is also work on the production of rich gas. Laboratory work has shown that coal can be hydrogenated to give a gas of calorific value equivalent to, or higher than, that of town gas.

**Coke**

Although, states the report, inland coke sales rose by 1·6 per cent. the year's sale of 7·9 million tons was somewhat disappointing compared with the strong recovery in sales of house coal and other boiler fuels, which were 6 per cent. better than the previous year.



*A40 body shells in a gas-fired oven, for baking after spray painting at the B.M.C. Works, Longbridge, Birmingham*

On the domestic coke position, which is of primary importance to clean air progress, we cannot do better than quote in full the two paragraphs in which this is discussed:

" During the year substantial progress has been made in implementing the recommendations of the Peech Committee (see paragraphs 203 and 204 of the Gas Council Report for 1959-60) on the availability. suitability and adequacy of solid smokeless fuels to meet the needs of the Clean Air Act. The high quality free-burning coke for use in modern appliances called for by the Beaver Committee on Air Pollution, and covered by British Standard 3142, is sold by Gas Boards under the trade names of ' Gloco ' and ' Sebrite '. The production of these cokes is rapidly being extended to cover most parts of the country. At present, British Standard cokes are being made by ten Boards, although they are not yet on sale in all parts of the Areas. Consumer reaction to these fuels is excellent; nevertheless, their availability is greater than the demand. Gas Boards are also producing, from special coals, highly reactive cokes which are sold under the trade names of ' Cleanglow ' and ' Phimax ' and which can be burned satisfactorily in old-fashioned coal grates. Progress by local authorities in creating clean air zones has fallen short of what has been planned. From approximately 340,000 tons of all types of solid smokeless fuel were required for zones in operation, and the forward requirement for zones in operation up to October, 1961, is about 680,000 tons per annum. The present availability of gas industry named cokes is very much in excess of this amount and the development of production of these fuels by Gas Boards is accelerating at a greater rate than that indicated by the Peech Committee. In many Areas the fuels are already being sold where

the smoke control programme is in its very preliminary stages.

" While the production of highly reactive cokes is material to the successful implementation of the Clean Air Act, the importance of their production should be kept in proper perspective. Their principal advantage is that they can be burned in old-fashioned grates in the same way as coal. While users must be allowed freedom of choice, nevertheless, the highly reactive fuels are more expensive than coke and it is the experience of Area Boards that while a proportion of householders in newly - created smoke control areas initially demand this type of fuel, there is a gradual changeover to the cheaper fuels such as ' Gloco ' and ' Sebrite '.

" Under the aegis of the British Standards Institution, attention is now being given to the preparation of a new British Standard for domestic coke for use in boilers and closed appliances."

## Natural Gas for Britain

The Minister of Power has approved the plan of the Gas Council for the importation of natural gas from the Sahara, which will eventually lead to lower costs of gas supply in Great Britain.

In a statement, Sir Henry Jones, Chairman of the Gas Council, said that it was hoped that in about $2\frac{1}{2}$ years' time two specially constructed tankers would begin to operate, conveying 354 million therms per annum to a terminal at Canvey Island, Essex. These deliveries are expected to provide about one-tenth of total gas supplies.

The gas will flow through an existing main from Hassi R'Mel to Port Arzew, near Oran. There it will be liquefied in a plant to be installed. Then, at $-258°$F. and occupying only 1/600th of its original volume, it will be transported in similar fashion to the cargoes already carried from the Gulf of Mexico. The liquid methane will be stored in tanks to be built by the North Thames Gas Board near their existing tanks at Canvey which will also be used. It will then be pumped to regasification equipment and after that transmitted through a new steel main laid for the purpose to at least seven of the twelve Area Gas Boards, *i.e.* North Thames, Eastern, South-Eastern, Southern, East Midlands, West Midlands and North-Western. Other Boards may also be supplied.

The huge Hassi R'Mel field in the Sahara from which the methane will be drawn has proven resources sufficient to supply gas on the scale mentioned for very many years. It is claimed to be second only in resources to the Panhandle field in the U.S.A.

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**Glasgow's Electric Flats**

In our Summer issue, reviewing the annual report of the South of Scotland Electricity Board, we published a photograph of a block of 20-storey flats being erected with electrical floor heating in Glasgow. These are in the Royston district, and the Board has now published an attractive illustrated booklet describing the installation, with technical details and costs. It also includes general information of the actual costs experienced in other electrically floor heated blocks elsewhere in Scotland which have been in use for several years. Copies of the brochure may be obtained from the Board at Inverlair Avenue, Glasgow, S.4.

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**Conference Publicity**—*concluded*

experts in Pittsburgh, and here the need for international comparison of air and illness was stressed. And between debate and discussion one could look at the excellent exhibition of all sorts of appliances which enable us to burn fuel efficiently without suffocating our neighbours.

" This Society, of enlightened men and women, has been responsible for great strides in cleaning up our air, and all of us who breathe owe the Society far more than we know."

# Statement on Smoke from Diesel Vehicles

*This statement by the Executive Council of the Society has been submitted to the Ministry of Transport and was also placed before the Brighton Conference for approval. With reference to the final paragraph, the Ministry has agreed to meet a deputation from the Society to discuss the proposals.*

## INTRODUCTORY

1. Following the papers and discussion on road vehicle pollution at the Harrogate Conference, 1960, the Technical Committee has held a series of meetings on the subject, including discussions with representatives of the principal national road transport organizations and others. Their conclusions, which have been discussed with the Parliamentary and Local Government Committee, have been approved by the Executive Council.

2. There is widespread public concern, often strongly expressed, over road vehicle pollution, and especially over the dark smoke from diesel vehicles. With the growing volume and density of road traffic the problem is becoming increasingly serious. Although this statement is concerned with pollution from diesel engines it should be emphasized that, as far as the effects upon health are concerned, the exhaust fumes from petrol engines —containing carbon monoxide, aldehydes and lead compounds—may possibly be more harmful, and they at least warrant much more investigation than they have received.

3. The reasons for public complaint about diesel smoke and gases, and the demand for more effective prevention, are: (1) Possible danger to health. Although there is so far no firm evidence on this, and many statements that have been made appear to be exaggerated, the possibility of such dangers, even if only in certain circumstances, cannot be ruled out. (2) Danger to road safety from the obscuration of visibility and the sense of impatience suffered by the drivers of following vehicles. (3) The deposition of black and greasy dirt on other vehicles and their passengers, and on roadside buildings, pedestrians, and vegetation.

4. The extent of the nuisance on roads carrying much diesel traffic is shown by recent investigations on the Archway Road, North London, by the Hornsey Borough Council in conjunction with the Warren Spring Laboratory of the D.S.I.R. (see *Smokeless Air*, Autumn, 1961). The measurements recorded show that the smoke pollution level on the road is on the average many times greater than the smoke pollution of the surrounding district.

5. It is concluded that the nuisance, in streets and roads frequented by diesel vehicles is most serious, and that present control or preventive measures are failing to reduce or even to check its growth.

6. The new Regulation to prevent the excess fuel device being used while a vehicle is moving is welcomed as being likely to remove one notorious cause of excessive smoke emission.

## THE PRESENT POSITION

7. The present method of control by the Police, under the Road Traffic Act and Regulations, is based on it being an offence to emit smoke, etc., that is likely to cause damage, injury or danger. This has had, at best, only a limited effectiveness, and clearly is designed to deal only with excessive emissions for which a conviction can be reasonably expected.

8. To strengthen these existing powers, proposals have been made for, and attention has been given to, the use of meters, instruments or shade charts to measure smoke density; and for it to be an offence to exceed a stipulated limit. Although instruments for measuring smoke from a stationary vehicle under test are in use and are valuable, the measurement of smoke from a moving vehicle, with a view to legal action, appears to be technically and administratively uncertain, and, if the procedure proposed below is adopted, to be unnecessary.

9. Devices for the removal of smoke after its formation (and for the removal of unburned hydrocarbons from petrol exhausts), by catalytic action, or after-burning, have been much discussed, especially in the U.S.A. Although certain devices have been accepted for testing by the Californian authorities (with a view to making their installation obligatory) none have so far been approved. Although such devices might have some value, we are doubtful whether they could be regarded as more than secondary to measures for promoting correct combustion and engine usage. Similar reservations can be applied also to the use of fuel additives and the discharge of exhaust gases at the top of the vehicle.

10. We have found that it is generally agreed that the principal reasons for smoke emission from diesel vehicles are: (1) failure to maintain the engine or to operate it in an efficient manner; (2) over-loading of the vehicle in relation to the power of the engine, and (3) improper use of the engine or vehicle. The engine should be so maintained and operated that, as in any other fuel-burning equipment, as close an approach to complete combustion as is possible is obtained. It is therefore concluded that control for smoke prevention should be directed towards ensuring that these necessary conditions are secured, rather than simply by making it an offence to emit smoke.

11. We are of the opinion that the best practicable approach to the question of ensuring correct maintenance is that already used by the Ministry of Transport, whose Examiners have powers to enter and inspect vehicles, and to enter premises " for the purpose of ensuring that goods vehicles are maintained in a good and serviceable condition." They also have powers to prohibit the use of a vehicle for the carriage of goods or passengers which (in the Examiner's opinion) is likely to constitute a danger to other road users. Since the Regulations require that every motor vehicle shall be so constructed that no avoidable smoke or visible vapour is emitted therefrom, the Ministry's Examiners can, and in practice do, prohibit the use of badly smoking vehicles. At present although this control may not be exercised as widely or as strictly as may be necessary, the system appears to be potentially the most effective, equitable, and constructive form of control available. As we envisage it, it is similar to the powers recently brought into force under which a vehicle can be halted and checked for brakes, steering, lighting, etc.

## PROPOSALS

12. We therefore propose:

(i) That the present practice of vehicle examination by Ministry of Transport Examiners be expanded and applied more strictly, if necessary by stages, to whatever extent may be necessary.

(ii) That the Ministry's staff of Examiners be increased as may be required, with the setting up of training courses if sufficient qualified persons are not available.

(iii) That co-operation between the Examiners and the Police in this form of control, which we understand already exists, be developed further; and that attention be given to the

difficulty that arises from the fact that an Examiner is not empowered to halt a moving vehicle (although he can serve a notice on one that is stationary). The powers that are required should, in general, be shared by Police and Examiners.

(iv) Attention should also be given to the difficulties arising from the lack of powers to deal with empty goods vehicles.

13. The opinion, or visual judgment, of the Examiner suffices, under present practice, for the purpose of stating that a maintenance test is required. This is similar in principle to the visual judgment of an experienced Inspector in the case of chimney smoke emissions that is explicitly permitted in the Clean Air Act (S.34(2).). In the present case however the notice is not in the nature of a summons for an offence, and an offence arises only in cases of obstruction or failure to comply with a notice (when in our view it should be answerable by the owner to hirer of a vehicle). We see no reason why this practice should not continue under the expanded control proposed, thus obviating the need for measurement instruments.

14. It has been impressed upon us that even well-maintained vehicles may emit excessive smoke, especially at starting, accelerating and hill-climbing, if they are overloaded for the power of the engine. The present maximum load figure is not related to the engine and is not relevant. It is therefore proposed that the maximum load for any type or class of diesel engine should be determined either by the application of an agreed general formula based on horse-power, or by the testing and grading of each type or model of engine. It should then be an offence for the overall load to exceed the permitted maximum. The practice of London Transport, for example, in under-rating their buses by about 10 per cent. of the engine rating, is one that might be made obligatory. The ways and means for setting the standards required or of testing classes of engine need to be studied, and it is conceded that there may be difficulties to overcome. But we believe that it is essential that the principle proposed should be adopted and applied as soon as possible.*

15. Further proposals, related to those outlined above, are that steps should be taken to encourage the regular and systematic servicing of all diesel vehicles on the lines adopted by some of the larger and more progressive fleets. It is our view that the proposals we have made would serve as a direct and valuable stimulus in securing proper maintenance and the avoidance of overloading. A certificate with respect to smoke prevention should be required on the sale of all used diesel vehicles.

16. Educational and publicity activities, addressed to the owners and drivers of vehicles, on the importance of maintenance, avoidance of overloading and the dangerous and harmful effects of smoke emission, should be considerably expanded. The Society would be glad to have the opportunity to assist in such work.

## CONCLUSION

17. We recognize that our proposals involve technical and administrative difficulties that call for careful study, and that their application will cost money. The seriousness of the problem however fully warrants such study and expense.

(*Concluded on page 130*)

* An alternative to control by limitation of load that has been suggested to the Society is a regulation to require that the fuel stop (which controls the injection of the fuel) should be sealed at a specified point below that at which smoke formation begins to occur. In the absence of proper maintenance deterioration of conditions would narrow this margin, but until this has occurred it is stated that smoke production would not take place even with overloading. One form such a regulation might take would be to prohibit the use of a vehicle with a maximum available power output of say more than 90 per cent. of the rated output as claimed by the engine manufacturer.

# Ministers Inspect New Smokeless Fuels Mobile Exhibition

## *Dr. Hill's First Clean Air Speech*

*A new mobile exhibition for the "living" display of solid smokeless fuels was on view in the forecourt of the Charing Cross Station on October 20th. The vehicle is cleverly and attractively designed, and as with the earlier mobiles of the S.S.F.F. will no doubt be in constant demand by local authorities for their smoke control area publicity.*

*The exhibition was inspected, among others, by the new Minister of Housing and Local Government, Dr. Charles Hill, and the Parliamentary Secretary, Ministry of Power, Mr. John C. George. At a gathering afterwards addresses were given by both Ministers. The material of Mr. George's was naturally akin to parts of the longer address he gave at the N.S.C.A. Brighton conference, which is printed in full in this issue, but Dr. Hill was heard with particular interest for his first speech on the subject of clean air. We are therefore recording it* verbatim. *Dr. Hill said:*



*Dr. Hill, left, in the mobile exhibition, with Mr. Giblin, S.S.F.F., Manager*

I AM here this morning in my capacity as the Minister responsible for dealing with smoke pollution of our air, and I warmly welcome the help of the Solid Smokeless Fuels Federation. It is bad enough that a smoke pall over a town shuts out sunlight, makes its buildings grimy and depressing, causes heavy expenditure on such things as cleaning and renovating buildings or on laundry. Most important of all, air pollution is a serious threat to health.

Recent research indicates that it is one of the most serious causes of chronic bronchitis, sometimes known as the English disease because it kills 30,000 people a year in this country, and causes the loss of 20 million working days a year. All this is avoidable. Money and effort spent in cleaning our air could not be better spent. They are an investment paying high dividends in the form of cleaner and easier home conditions for the housewife, brighter and more cheerful towns, and, above all, in improved health.

Serious smoke pollution is not, as is often supposed, confined to industrial districts. It is in fact one of the evil legacies of urban concentration—the crowding together in towns of large numbers of people most of whom traditionally heat their houses with coal fires. The domestic chimney produces a good deal more than half the smoke in the air of a typical large town and in some places the proportion is much higher.

The control of domestic smoke is indispensable if we are to clean our air. Many local authorities are now really getting to grips with domestic smoke. In 1957, the first year after

the passing of the Clean Air Act, some 18,000 premises in England and Wales were covered by smoke control orders. Progress in 1958 was more than three times greater, and 62,000 premises were covered during the year. In 1959 the rate of progress more than doubled and 150,000 premises were covered. In 1960 progress again more than doubled and 380,000 premises were covered.

Progress during this year suggests that by December the cumulative total of premises covered by smoke control orders may be around the million mark. Most of these premises are in the black areas. This is not too bad a start, although it is only a start. Many millions more premises in the black areas will have to be covered by smoke control orders before smoke is eliminated from the worst areas.

Coal can be burnt smokelessly in the big industrial appliances but not in the home. Domestic smoke control means that the householder has to switch from coal to some other form of fuel. In a smoke control area the householder has a choice of solid smokeless fuel, gas, electricity or oil.

A high proportion of householders plump for solid smokeless fuels, no doubt because of their traditional attachment to the open solid fuel fire. A variety of excellent solid smokeless fuels is now on the market. It is not possible to guarantee that householders in smoke control areas will always be able to obtain the particular kind of " premium " fuel they prefer—premium fuels are more highly reactive and, in burning qualities, are more akin to coal, than coke is. But over most of the country there are ample supplies of good quality open fire coke. There is still, I know, a lingering prejudice in some quarters against this fuel.

This has no doubt arisen because people in the past have tried to burn coke in an unsuitable appliance. In fact coke, provided it is correctly used, provides excellent, highly economical and cheerful open fire heating. The new approved type of appliances are ideal for burning it, and there is now a very large production of British Standard coke, known as Gloco, which is particularly suitable for open fires.

When householders have to make the change from coal to a smokeless solid fuel there may well be teething troubles. For example, people may wonder what is the most suitable type of smokeless appliance or fuel to meet their particular needs. They may not know how to get the best out of the new appliances. They may not know how to burn coke, since this requires a rather different technique from burning coal.

These are all highly important things in family life. Exhibitions of the type you have seen can play an invaluable part in bringing the necessary advice and demonstrations to householders in smoke control areas. They also show very clearly the positive advantages of smokeless fuels and new appliances, in particular the advantages of cleanliness, ease of handling and greater efficiency. They help to overcome any reluctance that some householders might feel towards the changes they have to make, and make it easier for councils who are rightly determined on smokeless air in their areas to carry local opinion with them the whole way in this really big twentieth century advance in public health and public well-being.

I would like to thank and congratulate the Solid Smokeless Fuels Federation for the excellent job they are doing.

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**Diesel Statement**—*concluded*

18. The Society would welcome an invitation from the Ministry to meet a deputation to discuss the proposals made. As the problem affects the well being of the community, which is the concern of the Ministries of Health and of Housing and Local Government, and the Department of Health for Scotland, the interest of these departments in the proposals would also be welcomed.

# *Clean Air Exhibition, Brighton 1961*

## by Tom Wenham

**This is the first prize winner in the senior section of the Essay Competition for schoolchildren in Brighton organized by the Society. The Essay has not been cut or edited in any way. We congratulate its 15 year old author on his excellent and most readable entry**

" *Ships, towers, domes, theatres and temples lie*
*Open unto the fields, and to the sky;*
*All bright and glittering in the smokeless air.*"

BRIGHTON, famous for its Royal Pavilion and its " Old Town " became for three days, in October, the part-time nucleus for the National Society for Clean Air. The Corn Exchange, and surrounding area, held many new, and some not so new, " gadgets " for the prevention of air pollution. A conference was held by the Society, running from the morning of Wednesday, October 4th, until Friday, October 6th, the last day. On the Thursday there occurred a most novel and enterprising thing.

At 4.30 p.m., the Mayor of Brighton, Councillor George Baldwin, telephoned to Mayor Joseph Barr, of Pittsburgh, Pennsylvania, and by doing so launched the first ever transatlantic telephone discussion on air pollution. The call, which lasted thirty minutes, was made to the Mellon Institute in Pittsburgh, and the thirty minutes were spent discussing mainly the effects of air pollution on health, the causes of air pollution and ways of tackling the problem. The cost for the call was nearly four hundred pounds and was paid for by a national firm of pharmacists.

This telephone call illustrates two things: (i) the need for international information, which can bring about nothing but improvement and progress, and (ii) the need for publicity. The latter being a very important factor. There are numerous ways of publicising such a Society as " Clean Air," for example, posters, rather like the road death posters, illustrating gruesome deaths, could be designed to illustrate the 1952 tragedy. Posters such as these would affect the domestic intruders rather than the large industrial concerns. Leaflets, an ideal and probably the best way of illustrating anything, could be distributed throughout the industrial concerns, giving statistics of damage caused by air pollution and also methods of preventing it.

These, and many other things, such as exhibitions and conferences, are already being done, and its effect is noticeable, though as officially stated, not as noticeable as it should be.

The Exhibition at Brighton consisted of two sections, A and B, and both halls were similar in objective. That is to say, both showed the public how the Clean Air Act was faring, showing large maps of Great Britain illustrating clearly Britain's smokeless zones and the worst areas for present pollution, or they wanted to show methods of preventing pollution. Stands such as the Central Electricity Board, the National Coal Board, the Gas Board, numerous smaller groups, were present and they put over mainly the factor—smokeless fuels.

The Conference Hall was a very busy place. In it, subjects such as:

The Clean Air Act; the Bill for the Certification of Furnace Operators; a report on the National Survey of Air Pollution; industrial problems; domestic problems and smokeless fuels were discussed.

Smokeless Fuels! This is a very important factor in the prevention of air pollution and quite a lot depends on and expands around it. But it also puts some concerns in a very difficult position and one concern in that position is the National Coal Board. The Coal Board wants to give all possible support to the Clean Air Act, that is part of their duty as a public organization. But apart from being a public organization they are also a commercial body and the Clean Air Act could help quite a bit to put them out of business. The Coal Board have therefore taken the Clean Air Act as a challenge, as an opportunity to show that they can align themselves with a progressive body and show that coal can be a modern fuel too. In 1957 coal was put in a bad position by the Exempted Fireplaces Order and since then has never been given preference to oil, until quite recently. Already fifty million pounds have been spent on coal washeries and a lot more is to be spent. The Coal Board, in conjunction with the National Industrial Fuel Efficiency Service, are doing a lot of research into the question and getting interesting results. They found, for example, that eleven per cent. of smoke emission cases were caused, last year, by the wrong fuel being chosen in the first place.

Therefore in the Coal Board there is a sense of challenge and they have overcome the problem and are now levelling with other fuel producers throughout Great Britain. All this was clearly shown by leaflets and diagrams at the Exhibition.

One thing not shown at the Exhibition was the early history of the clean air campaign, that might have had good advertising value. 1661 was probably the beginning of the campaign for it was exactly three hundred years ago that John Evelyn wrote of the City of London's smoke problems in " Fumifugium, or the Smoake of London Dissipated." It was presented to King Charles II who was interested, but that was about all. As in many other movements things died out for a while, and then in 1933 " Fumifugium " was republished, and once again in 1961. This illustrates the centuries-old concern for clean cities and clean air.

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The question may be asked, " Why bother about clean air? " and the Exhibition answered this in no short form. The all-important reason is the effect on man itself and other reasons include: beautiful places being ruined, cities being " charred " black by smoke and grime, and its effect on agriculture.

The effect on man's health is abundant. As said by P. J. Lawther, M.B., M.R.C.P., the gross manifestation of gross pollution is death. An example of this is the December of 1952, in the London area, over 4,000 deaths were attributed to it. Attributed to what? Smog, and smog is caused by smoke and grime. The smoke and grime are due to a disease of the respiratory or cordivascular systems. Bronchitis and cancer of the lung are caused, to a certain extent by smoke pollution. Chronic bronchitis kills 30,000 people a year, and smoke when it penetrates the bronchial tubes prolongs or worsens the disease. Cancer of the lung is a relatively" new" disease, and there are two good reasons for suspecting that air pollution plays a part in the disease—lung cancer is commoner in towns than in rural areas, and town smoke contains many substances which can cause cancer in experimental animals. Lung cancer may, therefore, be caused by the smoke billowing from the chimney of a huge factory or by the relatively minute amount inhaled by a cigarette smoker.

Another reason for the prevention of air pollution is the marring of beauty all around us. Cathedrals, churches, historic buildings, etc., are all being ravaged by smoke and grime, turning them into buildings that

resemble nothing else but pit-head buildings. An example of this is the statue of Charles II in Soho Square, an historic monument blackened by smoke and grime almost beyond recognition.

Yet another reason is the effect on agriculture. Dust and grime is settling on grazing land so that milk production has been suffering. Domestic animals are contracting numerous diseases. Fluorine poisoning is one of the worst and in Bedfordshire one farmer lost £25,000 worth of stock, comprising 68 cows and 110 calves and 500 chickens.

All this surely is reason enough.

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When one reads of such statistics and facts as: The effect and magnitude of carbon monoxide, a toxic substance, highly poisonous, is increasing on Britain's roads; the take-off of one commercial jet airliner has been estimated to create a quantity of air pollution equivalent to that produced by 6,850 passenger cars; more than 10,000 people have been advised by doctors to leave Los Angeles because of the effects of smog on their health, one can say only one thing:

Three cheers for the National Society for Clean Air, and three more for the Exhibition at Brighton.

The latter having shown the South-East of England what determination and a purpose can do when helping others. Their objectives are to prevent the thousands and thousands of deaths caused each year, to prevent the historic memorials, the objects of beauty, being spoilt by air pollution. Their ultimate aim is obvious, to create a better world, non-politically, to live in, and the Exhibition at Brighton has illustrated this perfectly.

## *Some Extracts from other Entries*

The Exhibition shows clearly what enormous problems scientists have to face, not only in trying to bring about clean air and eradicating the menace of smoke, but also of educating the people in the smoke-laden districts of the advantages of smoke-free atmosphere and of the danger to health when smoke is present in the air, and of the necessity of keeping the dirt and grime to an absolute minimum and eventually eradicating it altogether.—*Pamela Ann Leggatt.*

Walking round the hall, I soon changed from an iceberg into a warm glowing person.—*Margaret Brown.*

These changes will cost you some money, but in the " long run " the savings will be affected as your home will be cleaner and stay cleaner longer. It will reduce your laundering, painting and decorating. Your district will be cleaner and the new grates will give more heat for less fuel. Not only is this economical but it also means that we are all in our small way assisting to make our country a cleaner, healthier place to live in.—*Carol Ann Edwards.*

My general impressions of the Clean Air Exhibition were that it was much healthier, safer, cleaner and cheaper to use other means of domestic and industrial heating, rather than the sooty, smoky ordinary coal. Also the exhibitors were very helpful to solve any problems which one may have.—*Jacqueline Elliott.*

To conclude, the National Society for Clean Air is doing a magnificent job in bringing about a radical change in the look of our industrial cities, and changing dirty, grimy surroundings into bright areas, where the sun can shine through a smoke-free atmosphere. I hope the Society will pay another visit to Brighton in the near future and continue its valuable work in educating the general public and making people realize the problems we are facing. I wish them luck.—*Pamela Ann Leggatt.*

# SMOKE CONTROL AREAS

## Progress Report

### POSITION TO SEPTEMBER 30th, 1961—TOTALS

| | England and Wales | Scotland |
|---|---|---|
| **Smokeless Zones** (Local Acts) in Operation.. | 44 | 1 |
| Acres, 3,400 | | |
| Premises, 41,060 | | |
| **Smoke Control Areas in Operation** .. .. | 376 | 12 |
| Acres, 54,552 | | |
| Premises, 351,701 | | |
| **Smoke Control Orders**— | | |
| Confirmed .. .. .. .. .. | 253 | 9 |
| Submitted .. .. .. .. .. | 142 | 12 |
| **Grand Totals** .. .. .. | 815 | 34 |

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Autumn, 1961), which give the position up to June 30th, 1961. They now show the changes and additions to September 30th, 1961.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

### ENGLAND AND WALES

#### New Smoke Control Areas in Operation

Aldridge U.D. Nos. 2, 3 and 5, Birmingham C.B. Nos. 4, 6, and 11 to 20, Brentwood U.D. No. 2, Brierley Hill U.D. Nos. 8 to 11, Bristol C.B. Nos. 2 to 5, *Church U.D. No. 1, *Coventry C.B. Nos. 1 and 2, *Denton U.D. Nos. 3 and 4, Dukinfield B. No. 1, Ealing B. Nos. 3 and 4, Finchley B. Nos. 1 to 5, *Halifax C.B. No. 2, Hammersmith M.B. No. 2, Harrow B. No. 1, Hayes and Harlington U.D. Nos. 13 and 18, *Heston and Isleworth B. No. 2, Heywood B. No. 2, Lewisham M.B. Nos. 6 and 7, *Manchester C.B. No. 2, Morley B. Nos. 1 to 7, *Padiham U.D. No. 1, *Prestwich B. No. 2, *Rotherham C.B. Nos. 2 and 4 to 10, *Sale B. No. 1, Sedgley U.D. No. 2, *Smethwick C.B. No. 2, Stoke Newington M.B. No. 10, Tottenham B. No. 2, Walsall C.B. Nos. 1 to 3, *Warrington C.B. No. 2, Willenhall U.D. Nos. 8 and 9, *West Bromwich C.B. Nos. 5 and 6, West Ham C.B. No. 1, *Wortley R.D. No. 2.

#### New Orders Confirmed but not yet in Operation

Aireborough U.D. No. 9, Aldridge U.D. No. 4, Altrincham B. Nos. 4 and 5, *Barnes B. No. 2, Barnsley C.B. No. 3, Batley B. No. 1, Bebington B. No. 2, Beddington and Wallington B. No. 2, Bingley U.D. Nos. 1 and 2, Birkenhead B. No. 1, *Blackburn C.B. No. 1, Brighouse B. Nos. 3 and 4, *Cheltenham B. No. 1, *Chesterfield B. No. 2, Church U.D. No. 2, Denton U.D. No. 5, Derby C.B. No. 2, Ealing B. No. 6, Finsbury M.B. No. 1, Greenwich M.B. No. 2, *Halifax C.B. No. 4, Hayes and Harlington U.D. Nos. 16 and 17, Hebburn U.D. No. 2, *Hornchurch U.D. No. 3, Huddersfield C.B. Nos. 3 and 4, Huyton-with-Roby U.D. No. 2, *Keighley B. No. 1, Kingston-on-Thames B. No. 1, Lewisham M.B. No. 9, Manchester C.B. No. 4, *Marple

U.D. No. 1, Merton and Morden U.D. No. 1, Middleton B. Nos. 7 and 8, Newcastle-upon-Tyne C.B. No. 4, Nuneaton B. No. 2, Old Fletton U.D. No. 3, Oxford C.B. No. 3, *Paddington M.B. No. 3, Poplar M.B. Nos. 7 to 13, *Rochdale C.B. Nos. 3 and 4, Sale B. No. 3, Scunthorpe B. No. 2, Sedgley U.D. Nos. 3 to 6, Sheffield C.B. No. 8, Smethwick C.B. No. 4, Southall B. No. 3, Southgate B. No. 2, Spenborough B. No. 2, Stalybridge B. No. 1, Stockport C.B. No. 4, Twickenham B. No. 1, Urmston U.D. Nos. 1 and 2, Wakefield C.B. No. 2, Wallsend B. No. 1, Walthamstow B. No. 2, Wednesbury B. No. 1, West Bromwich C.B. Nos. 7 and 9, Wigan C.B. No. 1.

**New Orders Submitted for Confirmation but not yet Confirmed**

Aldridge U.D. Nos. 6 to 12, Barnet U.D. No. 3, Birmingham C.B. Nos. 21 to 33, 39 to 47, 51 and 52, Brighouse B. No. 5, Carlton U.D. No. 1, Carshalton U.D. No. 2, Chadderton U.D. No. 3, Chesterfield R.D. No. 2, Coventry C.B. No. 3, Dagenham B. No. 3, Derby C.B. No. 2, Doncaster C.B. No. 6, Dukinfield B. Nos. 2 and 3, Eccles B. No. 3, Edmonton B. No. 4, Feltham U.D. No. 2, Finchley B. No. 6, Finsbury M.B. No. 2, Grantham B. Nos. 3 to 6, Hebburn U.D. No. 3, Hendon B. No. 2, Islington M.B. Nos. 5 and 6, Kensington M.B. No. 5, Kirkby U.D. Nos. 1 and 2, Leeds C.B. Nos. 6 to 19, Malden and Coombe B. No. 1, Merton and Morden U.D. No. 2, Nottingham C.B. No. 2, Old Fletton U.D. No. 3, Penge U.D. No. 1, Pontefract B. No. 2, Richmond (Surrey) B. No. 3, St. Marylebone M.B. No. 5, Salford C.B. No. 5, Sheffield C.B. No. 9, Shoreditch M.B. No. 4, Staines U.D. No. 2, Stoke Newington M.B. No. 7, Swinton and Pendlebury B. No. 2, Whitefield U.D. No. 3, Willenhall U.D. Nos. 10 to 13, Woolwich M.B. No. 13, Yiewsley and West Drayton U.D. No. 3.

## SCOTLAND

**New Orders Confirmed but not yet in Operation**

Edinburgh (Sighthill No. 4), Glasgow (Pollokshields No. 2).

**New Orders Submitted for Confirmation but not yet Confirmed**

Dumbarton Burgh Nos. 3 and 4, Edinburgh (Sighthill No. 3), Kilmarnock No. 1, Motherwell and Wishaw (Forgewood), Paisley (Foxbar), Grangemouth Burgh (Bowhouse No. 1).

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*Divisional News*

# VISIT TO STAVELEY

The East Midlands Division of the Society met at the works of the Staveley Iron and Chemical Co. Ltd., on October 26th. During the morning, split into small parties, the members toured the works and saw the departments dealing with the spinning of iron pipes, with castings and mouldings, and with engineering. After being entertained to lunch by the Company at Ringwood Hall a meeting was held, at which an address was given by Dr. R. V. Riley, Research Manager of the Company.

Dr. Riley entitled his lecture " Iron, Chemicals and Clean Air " and illustrated it with numerous slides. He explained the extensive schemes and research going on at the Works with a view to the reduction of air pollution. He applauded the aims of the Society and stated that complex problems arose in his industry.

Dr. Riley detailed the possible sources of pollution from large integrated iron and steel works. The modern gas-cleaning methods applied to blast furnaces and the production of coke and chemicals were described. The Clean Air Act has encouraged the firm to substitute diesel locomotives for the coal-fired engines and the change had also proved beneficial economically. Deposit gauzes and petri dishes were used for dust and grit measurement and he had recorded progressive reductions in pollution for some years.

There was considerable discussion and many questions were asked. The Chairman, Mr. Drabble, expressed the thanks of the meeting to Dr. Riley and to the Company for their hospitality and interest.

# ELECTRICITY PROGRESS

## New Reports

**The Electricity Council. Annual Report and Accounts, 1960-61. H.M.S.O. 9s. 6d. net. Central Electricity Generating Board. Annual Report and Accounts, 1960-61. H.M.S.O. 9s. 6d. net.**

THE third annual reports of the Electricity Council and of the Central Electricity Generating Board for the year ending March 31st, 1961, disclose an unusually large increase in the demand for electricity amounting to 12·1 per cent. over the previous year. The combined revenues for the industry including a net profit of £3·6 million from contracting and sales fittings amounted to £605·5 million compared with £552·7 million for the previous year, giving a consolidated surplus of £16·3 million as against £26·7 million for the year 1959-60.

The revenue of the Central Electricity Generating Board amounted to £425·2 million compared with £381·6 million for the previous year. The total sales amounted to 103,233 kWh as against 93,042 kWh during 1959-60 an increase of 11 per cent. The year's trading resulted in a deficit of £1,507,981 partly accounted for by the necessity of keeping in commission a number of the older less efficient stations owing to the unexpectedly heavy demand.

It has become apparent that the 1958 estimate of capital requirements for the industry will require revision. It was then forecast that the capital requirements for seven years to 1965 would amount to £2,130 million at 1958 price levels, of which it was hoped to finance from internal resources 48·6 per cent. When the industry



*The Berkeley Nuclear Power Station*

came under public ownership in 1948 the British Electricity Authority was authorized to borrow up to £700 million. In 1953 this was raised to £1,400 million, and in 1959 to £1,800 million or such greater sum not exceeding £2,300 million as the Minister of Power might specify by Order. The Minister is to be asked to authorize the second stage of the borrowing.

The maximum demand on the Generating Board's plant amounted to 24,445 MW an increase of 5·9 per cent. to meet which 91·8 per cent. of plant was available. New generating plant of an output capacity of 1,668 MW was commissioned during the year and four stations were closed down, leaving 230 in operation, with a maximum output capacity of 27,067 MW at the end of the year. The thermal efficiency of generation was 26·80 per cent. The capital expenditure of the Generating Board amounted to £196·2 million—£159·3 million on generating plant and £31·2 million on new transmission works.

**Generation**

The size of generating units continues to increase. Two 200 MW units operating at 2,350 lbs. per sq. in. and 1050°F. were commissioned at High Marnham and orders have been placed for sets of 275, 300, 350 and 500 MW operating at 2,300 lbs. per sq. in. and 1050°F. Orders were placed also for sets of 375 MW operating at supercritical pressure of 3,500 lbs. per sq. in. and 1100°F. with reheat to 1050°F. with a design thermal efficiency of 39·8 per cent.

Nuclear stations at Berkeley and Bradwell were nearing completion and contracts were placed during the year for a 550 MW station at Dungeness and for a 580 MW station at Sizewell in Suffolk.

The Generating Board's power stations used 49 million tons of coal and coke and 5½ million tons of oil, equivalent in all to 58 million tons of coal. The maximum demand of electricity may reach 50,000 MW in 1970 when the coal equivalent required would be of the order of 100 million tons, of which a part would be supplied by nuclear fuel.

The total length of the Generating Board's grid amounted to 7,532 miles of which 1,488 miles were accounted for by the 275 kV super grid. To reduce the number of high voltage lines to meet increasing power demands, the Board intends to introduce a 400 kV main transmission system, to meet which much of the 275 kV system will be reinsulated and provided with new transformers and switchgear.

The cross-channel link with France was completed on June 22nd, 1961, and is designed to admit of the transfer in either direction of 160 MW at 100 kV D.C. The purpose of this link is to meet the different conditions on the two sides of the Channel where daily peak demands do not coincide. Moreover, French stations have power to spare in the winter from their hydro-electric stations while in summer these stations sometimes lack water, and Electricité de France will be able to rely on power supplies from England.

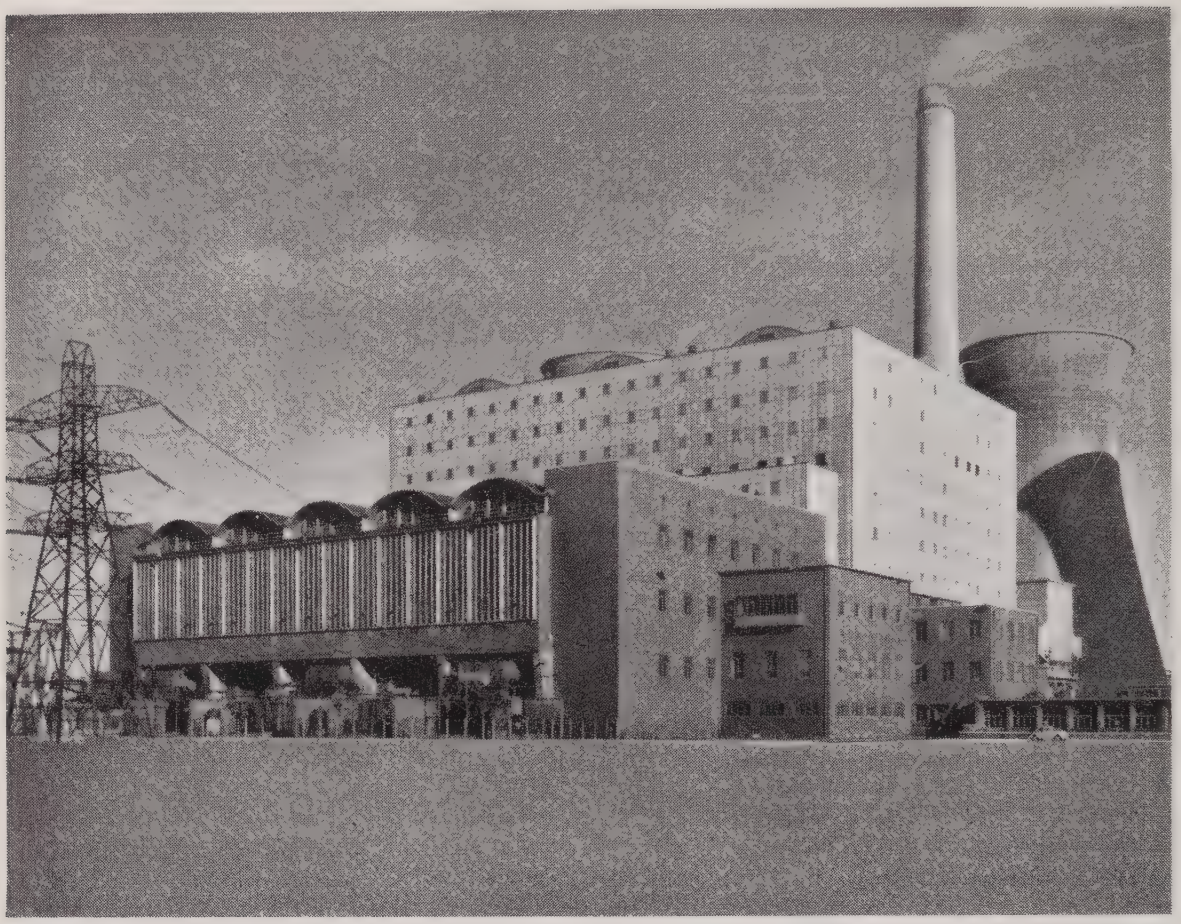
Four new stations were brought into operation during the year—Staythorpe B (Newark), Skelton Grange B (Leeds), Rugeley (Staffs.) and Uskmouth B (Newport).

**Air Pollution**

Every care is taken to prevent atmospheric pollution. Modern power stations are provided with grit-arresting plant with efficiencies as high as 99·3 per cent. and flue gases are emitted high in the atmosphere from chimneys of 550 to 600 feet.

The demand for electricity is rising more rapidly in the South of England than elsewhere and this can be met either by building generating stations on the South Coast or by building stations nearer coalfields and transmitting power by the grid. The latter course has some disadvantages and local generation in nuclear power stations offers a solution. To this end consideration has been given to the possibility of stations in the Isle of Wight or on Southampton Water.

Research is being carried out in



*The Ferrybridge "B" Station, Yorkshire*

many directions and to assist in this the Leatherhead Laboratory has been extended, a nuclear laboratory has been built at Berkeley and an Engineering Laboratory has been established at Marchwood near Southampton. Research has been carried out on coal and oil burning conditions in boilers, on the uses of pulverized fuel ash, reclamation of ash dumps and converting the ash into arable land, on behaviour of turbine blades at high temperatures, in the use of cooling water, alternative power cycles, and the direct-generation conversion of heat to electricity. Research into problems connected with nuclear generation is carried out in conjunction with the United Kingdom Atomic Energy Authority. Investigation is being carried out on problems concerning insulation of the 400 kV grid.

**Demand**

Of the total units sold of 96,053 million units 46,702 million went to industry, 31,636 million to domestic consumers and 11,980 million to commercial consumers. Sales to industry per employee is now 6,000 units as compared with the U.S.A. figure of 24,000 and West Germany of 7,000.

The maximum demand on the system occurred during the half-hour ending at 5.30 p.m. on Tuesday, December 13th, 1960, and amounted to 24,445 megawatts supplied at full voltage and frequency.

Sales of electricity restricted to off-peak periods increased considerably, to 1,400,000 kW for storage space heating, 650,000 kW for floor-warming, 550,000 for storage block heaters, 200,000 for water heating. The increase in off-peak loads will contribute to improving the load factor of the system which during the year under review was 49·4 per cent.

At the end of the year 193,174 persons were employed in the industry. —*A.J.C.*

# GRIT AND DUST

**Measurement of Solids in Flue Gases. P. G. W. Hawksley, S. Badzioch and J. H. Blackett. pp. 214. 32s. 6d. net.**

**Surveys of the Art of Cleaning Flue Gases. R. Jackson. pp. 48. 5s. net.**

**Both published by the British Coal Utilization Research Association, Leatherhead.**

The practical experience gained in the field and in the laboratory on the sampling of grit, dust and soot in flue gases carried out over the past few years has been summarized in the first of these B.C.U.R.A. publications. It has been prepared for engineers and others concerned with meeting the provisions of the Clean Air Act 1956, and also for research investigations dealing with the design and operation of boiler plant and gas cleaning equipment.

Part One of the Handbook gives explicit instructions for measuring the emission of grit and dust by means of the cyclone probe equipment devised by the Association. Messrs. Airflow Developments Ltd., Lancaster Road, High Wycombe, Bucks., collaborated in the design of the equipment described, and now manufacture it for sale. The recommended procedure is simple, sufficiently accurate for most purposes, and is especially suitable for the smaller industrial boiler which often cannot be operated steadily and uniformly and in this respect may prove of wider application than that of B.S.3405 " Simplified Methods for Measurement of Grit and Dust Emission from Chimneys".

The second part deals with the general principles of measuring emission. Methods are described that may be employed in the more difficult cases not covered by the simpler procedure and these can be readily followed by personnel who have gained some practical experience.

The third part discusses the physics of sampling of solids from flowing fluids and, since it assumes a knowledge of statistical techniques, is more suited to the needs of research investigators. The discussion includes accounts of the theory of the motion of particles in fluids with application to the collection of solids by a sampling nozzle, the impaction of solids on obstacles and the cleaning of gases by cyclone-type collectors. The third part contains also the evidence, obtained from the field tests, for assessing the errors of sampling; in particular, the accuracy of measurement is shown to depend more on the total duration of sampling than on the steadiness of operation of the plant or on the number of sampling points. This conclusion led to the procedures recommended in the first two parts.

The Handbook has eleven Appendices which give a full description of the B.C.U.R.A. cyclone probe and of the construction and use of pitot tubes, calibration data for the cyclone, a simplified method of calculating free-falling speeds of particles, a note on the optical density of smoke and an account of Yates' tabular method of factorial analysis which is particularly suitable for computation in statistically designed sampling experiments.

Once the nature and quantity of solids emitted from a given plant are known, steps can be taken to remedy any excessive emission; and surveys of the literature have been prepared on simple gas cleaners such as settling chambers and low resistance dust collectors. These have appeared as Reviews No. 189 and No. 199 in the Association's Monthly Bulletin, and reprints have now been made available in a booklet, " Surveys of the Art of Cleaning Flue Gases: I. Settling Chambers for the Collection of Grit; II. Mechanical Dust Collectors of Low and Medium Efficiency," by R.

Jackson. Although the designs of such collectors are often arrived at empirically and there is lack of reliable data on their efficiencies, these collectors are likely to be adequate in many cases, especially for the smaller boiler plant, provided that they are correctly installed and properly maintained.

## RADIOACTIVE WASTES

**Treatment and Disposal of Radioactive Wastes. C. B. Amphlett. pp. 289. Pergamon Press, Oxford. 70s. net.**

This is a volume in the publisher's International Series of Monographs on Nuclear Energy. It is a full review of the problems of the control of radioactive wastes, and includes a chapter on the treatment and disposal of gaseous wastes.

It is pointed out that the methods which were originally practised were relatively simple in concept, and were based largely on the alternative philosophies of indefinite storage or of dispersal to the environment; methods of treatment were limited largely to evaporation or to relatively unsophisticated chemical treatment.

Within recent years, under the impetus of a steadily expanding nuclear programme involving considerable diversification, more attention has been paid to the problems of waste treatment; as a result many new processes are now available, some of which are in operation, while others have only been proven on a laboratory scale.

The author discusses these questions with authority and in a clear and practical manner. For those concerned with clean air the dangers of radioactive pollutants in the atmosphere is a special problem outside the conventional types of pollution and which have to be recognized as requiring the attention of either the nuclear physicists, as far as nuclear energy generation is concerned, or of the world's statesmen as far as nuclear explosions are concerned. Nevertheless, many non-specialists will want to learn more about what the problems are and how they can be dealt with, and this book will be found to be an invaluable guide to such studies.

# Grit and Dust Measurement

*New British Standard*

**Simplified Methods for the Measurement of Grit and Dust Emission from Chimneys. B.S.3405:1961. British Standards Institution, London. pp. 76. 20s. net.**

With the publication of this standard an essential step has been taken towards the formulation and applications of regulations to be made under section 7 of the Clean Air Act. This section is concerned with furnaces burning pulverized fuel or—at a rate of one ton an hour or more—any other form of fuel or solid waste. The regulations will prescribe requirements for the making and recording of measurements of grit and dust emission; adaptation of chimneys to allow these measurements to be taken; the provision of apparatus for this purpose; and informing or making available to the local authority the results.

The new B.S. is the result of the work of a technical committee set up by the Institute to prepare B.S. Recommendations for the simplified measurement of grit and dust, taking into account the requirements of the Act. It is pointed out that it does not supersede B.S.893, which gives the procedure to be used for making tests on large installations (*e.g.* power stations) and where accuracy is essential (as in contractural testing). The new Standard lays down the rules to be observed during a test in which an accuracy of within plus or minus 25 per cent. suffices.

The Standard describes the methods and apparatus to be used. At first sight the details might seem to be somewhat complicated and difficult,

but it is pointed out that the procedure " can be carried out by two operators, who need not be skilled technicians ", although " one of them should be acquainted with the basic theory and practice of sampling and should be familiar with the use of the selected apparatus and the performance of the necessary calculations ". The apparatus required and described is such that the whole operation of sampling can be completed in one hour by not more than two operators.

Appendices, which take up the greater part of the volume, describe in detail the different instruments used, their operation, and include practical worked examples of the calculations required.

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**Measurement of Exhaust Smoke Density from Diesel Engined Vehicles. By J. D. Savage, M.I.Mech.E., A.M.I.R.T.E., A.M.I.Agr.E. A B.P. Technical Publication.**

This is a report of a paper read to the Institute of Road Transport Engineers which discusses smoke meters and methods of using them. The conclusions reached by the author are given as follows:

" Existing smoke meters may not be considered ideal for measuring the density of exhaust smoke emitted by all types of diesel engined vehicle, but they can be satisfactorily utilized provided that certain limitations are accepted and certain precautions taken.

" The limitations of existing instruments are related to:

(1) the difficulties of correlating results from different instruments,

(2) the smoke meter's inability to give readings corrected to engine size, or volume of exhaust gas,

(3) the need to conduct the test procedure with extreme care to avoid incorrect readings due to accumulated smoke, condensation, low sampling pressure, etc. (These limitations can mainly be attributed to the fact that the various systems in use employ sampling techniques which bring their own particular problems),

(4) the fact that they do not examine the full-flow characteristics of the exhaust gases as seen by the human eye.

" In addition to improving the existing sampling systems to reduce these limitations, the future development of smoke meters for vehicle work might take into consideration the possibility of a full flow photo-electric light-absorption meter. Reasonable correlation should be possible by employing the iris type shutter to correct the light absorption reading according to the size of the exhaust pipe or the capacity of the engine."

The reprint includes the interesting discussion that followed the reading of the paper.

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**Q. and A. on Coal**

A great deal of sound information about the coalmining industry is packed, in a very readable form, in a 24-page booklet published by the National Coal Board entitled **50 Questions and Answers on British Coal.**

The field covered is wide: from questions about the Board itself, types of coal, problems of production and the future, to manpower and its problems, exports, and science. There are also some useful tables of types of British coal, the deterioration of coal seams, mechanization and output progress and other principal statistics.

One question asks what the Board is doing to produce more smokeless fuel. The answer refers to the manufacture of coke and " Phurnacite " and to the pilot plants for two processes to make open-fire smokeless fuels, scheduled to start production at the end of 1960.

The booklet is a first-class piece of serious, but simple and clear, publicity on the basic facts about the coalmining industry that should be known to everyone.

# N.I.F.E.S. AND CLEAN AIR

## *Excerpt from Report*

*The 7th Progress Survey of the National Industrial Fuel Efficiency Service is as usual an illuminating record of the good work being done by the organization. One important change is reported in a statement by the Chairman, Sir Leslie Hollinghurst: instead of relying upon the fuel industries for the greater part of its income as hitherto, N.I.F.E.S. is to an increasing extent recovering the cost of its services to the fuel-using industries by fees. These earnings have increased from 32 per cent. of costs in 1955 to 70 per cent. in 1961. For this last year costs were £302,000 and earnings £211,000.*

*The report surveys work for selected industries—motor cars, malt whisky distilling and bricks, potteries, etc.—discusses the question of improving drying processes, and the recovery of waste heat in other selected industries. Of particular interest is a chapter on Clean Air, which because of the considerable interest it will have for readers of this journal, we reprint (except for a section on the corrosion of steel chimneys) as follows:*

**Smoke**

Since the Clean Air Act came into force, there has been a remarkable reduction in atmospheric pollution from industrial chimneys. N.I.F.E.S. has helped many industrial concerns to comply with the regulations, which define clearly the maximum amounts of smoke that may be emitted. It is generally agreed that the reasons why boiler plants give rise to smoke are, in order of importance, poor operation, inadequate maintenance and unsuitable equipment.

N.I.F.E.S. main contribution to improved plant operation has been through the courses for boiler operators described later in this Survey. To supplement these courses, intensive instruction on the man's own plant increases his confidence, particularly if it has been shaken by the realization that he has been creating a nuisance. This human problem, which is easy to overlook, was brought home to one of N.I.F.E.S. staff in a pleasant way. Before he left a works where he had been carrying out a programme of training, the wife of one of the boiler operators called to thank him and offer him a present. It appeared her husband had been so worried by the complaints about smoke—from the management, his fellow employees and neighbours in the street—that he had been losing his sleep, appetite and temper to the extent of nearly throwing up his job!

Some companies have bonus schemes for operating their boiler plants smokelessly. It is not always easy to devise satisfactory bonus schemes and N.I.F.E.S. would not advocate their general adoption. However, when companies which have decided to offer an incentive ask for help in establishing fair conditions, it is naturally given. Here is an interesting scheme, prepared for the *Liverpool Central Oil Co. Ltd.*, to cover the operation of two Lancashire boilers, mechanically fired with coal and fitted with an economiser. There are two operators per shift, and three shifts are worked. There is no chargehand and the supervision exercised by the Works Engineer is necessarily slight.

The bonus system, made up of three separate awards, is based on ability to maintain steam pressure, thermal efficiency, and smoke-free operation. The bonus on steam pressure, which is important to the process, is not paid if it falls below 150 p.s.i. gauge for more than 15 minutes in a shift. The control instrument is a pressure recorder in the Engineer's office.

The payment for thermal efficiency is based on a N.I.F.E.S. test, which

showed that efficiency, as found, was 65 per cent. but could be raised to 74 per cent. Efficiency is inferred from the survey results and from current determination of heat loss in the dry flue gas. Temperature and $CO_2$ are measured at the exit from the economiser, indicated in the boiler house and recorded, for control purposes, in the Engineer's office.

For smoke, an alarm and a recorder have been installed. The recorder has an edge-wise chart, marked off in shifts. The smoke density corresponding to the maximum allowed by the Clean Air Act is ruled on the chart. If the Act is contravened, this part of the bonus is cancelled for the shift. The company's fuel bill is approximately £750 per week and the Engineer has proved that since the bonus scheme was introduced the net savings have been about £50 per week.

Many of N.I.F.E.S. Regular Service Agreements were negotiated because there was a smoke problem to be overcome, and have been continued to ensure that the improvement is maintained. Often there are special problems to be solved; for example, the overloading of boilers, the burning of waste materials, such as wood, which may involve redesigning the combustion chamber, or the improvement of the draught systems.

**Grit and Dust**

During the year, there has been an increased demand for advice on the emission of grit and dust. The conditions in which effective grit arrestors must be installed are stated in the Clean Air Act, although no limits have been specified for the amounts of grit and dust that may be emitted. Curiously enough, this lack of regulation on quantity has led to a demand for measurement, so that the local authority may be satisfied that the arrestors are effective. N.I.F.E.S. officers have, therefore, been provided with apparatus for measuring grit emission and for analysing the size distribution of the material discharged. Besides determining the effectiveness of grit-collecting equipment already installed, the measurements can be used where advice is required on new construction. The range of problems to be tackled can be illustrated by the following examples:

*Imperial Chemical Industries Ltd.* wished to find out the carry-over of grit and dust when mixtures of coal and coke breeze, or of coke breeze and anthracene fat, were burnt at their Trafford Park factory. N.I.F.E.S. obtained the information required and was also able to suggest possible ways of improving the effectiveness of the grit arrestors installed.

N.I.F.E.S. engineers are often able to increase the value to the client of the measurements of grit emission by their ability to interpret them in a practical way. A good example is a survey carried out for *Helliwells Ltd.* of Aberdare, who were concerned about the amount of grit and dust that passed through the arrestor installed on their boiler plant. They therefore asked N.I.F.E.S. to measure the concentration in the gases leaving the chimney and to determine the efficiency of the arrestor. The investigation showed that, in fact, the root cause of the nuisance was that the induced draught fan was over-sized, and replacing it by a smaller one led to an improvement. Furthermore, N.I.F.E.S engineers found that the dust load in the flue gases could be reduced by improving the operational control of the boiler. Thus, the grit measurements showed that the arrestor itself was efficient; the survey, as a whole, uncovered the real causes of grit emission and led to a substantial saving of fuel in addition.

N.I.F.E.S. can be of assistance to the designers of equipment as well as to the users of it. *Joshua Bigwood Ltd.* of Wolverhampton, had developed the prototype of an inertial grit arrestor for vertical boilers and asked N.I.F.E.S. to assist in a comparison of service performance with design performance. The efficiency of grit collection was determined at different settings of the arrestor and from this information it was possible to simplify the design of the production model.

# *INTERNATIONAL SECTION*

*U.S.A.*

## TOMORROW IS ALREADY HERE*

*by*

*Ivan A. Nestingen*

*Under Secretary of Health, Education, and Welfare, U.S.A.*

I AM grateful to have this opportunity to talk about air pollution, a subject which, deservedly, is receiving considerable attention from the press and the public today. It is also something of a challenge to talk about so complex a matter before so knowledgeable an audience—the expert representatives of an organization which has been concerned with air pollution for more than half a century.

The fact that your association was formed 54 years ago is proof enough that even at the turn of the century one of the earliest and still troublesome forms of air pollution—smoke—had already become a problem in industrialized cities throughout the world—enough of a problem to make smoke abatement a matter of serious concern to serious-minded men.

In historical terms, this means that man was already well along the new road of using machines to replace muscles as the primary means of getting things done. In the process, he was changing radically the social, cultural, and economic bases of society. In short, by the time your organization was founded the industrial revolution was a fact.

In the meantime, most of us have had time to get accustomed to this particular fact of history. Every schoolboy knows that during the past two hundred years or so conditions of life on earth have changed more completely than they had changed during all the preceding years of civilization.

As a representative of an agency concerned not only with health and welfare but also with education, I ardently hope every schoolboy knows this.

But what every schoolboy does not know and what many of us who have been out of school for a good while may not know well enough, is that we are right in the middle of a new technological revolution which promises to bring about more revolutionary changes in man's physical environment than have occurred in any previous period since the dawn of history. This is an exciting fact, full of opportunities for human betterment, full of challenge—and full of problems.

As we look back to a century ago, when the original industrial revolution was underway, we can see that it too brought profound problems as well as blessings.

Through the shiny lens of our infallible hindsight we can clearly see many mistakes that should have been avoided. Squalor, overcrowding, a sense of rootlessness, and general misery comprised the lot of millions

* Before the 54th Annual Meeting of the Air Pollution Control Association, Hotel Commodore, New York; Tuesday, June 13th, 1961.

of people crowded together in newly industrialized cities.

Many compassionate observers, repelled by the overwhelming problems of the new environment, longed for an idealized bucolic past when there were no engines in London and Liverpool spewing smoke into the air and shaking the earth with their horrendous shrieks and groans.

Nevertheless, men moved into the future—smoke and noises, occupational hazards, overcrowding, and epidemics of disease notwithstanding. They moved ahead with the assistance of those responsible citizens who worked to find practical ways to minimize, with the best knowledge available, the many stresses and strains of disruptive change.

**Challenge**

Because of all the progress that has been made in curtailing poverty and disease during the 20th century, it is not easy to grasp the fact that we face a serious and similar challenge today. We also are caught up by a new technological revolution which offers the same alternatives of tremendous good or tremendous evil.

We also can hear voices beckoning us to turn backwards to one or another idealized version of the past. The future which our rapidly developing technology promises us today is just as difficult to understand in contemporary terms as was the future of the machine age for those people who lived during the period of transition a century ago.

Today, however, we have one great advantage that our ancestors did not have. We have the opportunity to profit by their mistakes—or to repeat them if we refuse to learn the lessons of history. We know that dramatic changes in technology produce dramatic changes in environment and that these changes inevitably make for dramatic differences in the problems of public health and welfare. It was not always so.

Let us take a look then at the text of the original industrial revolution.

One of the first lessons is that the unwholesome by-products of rapid and disruptive change came in for serious consideration rather late—after much damage had already been done.

Man was concerned about how to make a steam locomotive that would carry his goods to market before he worried about how to keep people from being run over at railroad crossings. He was concerned about how to get coal out of the ground before he worried about how to keep miners from being crushed or asphyxiated. He was concerned about how to construct machines to do work for him before he worried about how to make them safe for people to operate. He was concerned about getting workers into the cities to operate the new machines before he worried about whether their living conditions were safe and sanitary.

It is not easy to dismiss all this with a shrug of the shoulders as ancient history. Since the beginning of our own century we have been altering our environment in similar proportions, and we also have, for the most part, placed the greatest emphasis on making immediate use of our new discoveries and inventions and we, too, worry about the consequences somewhat later.

In the five decades since your association was first established, the simplicity of telegraphy has given way to the complexity of television. A few thousand automobiles that had not yet won the competition with the horse and buggy have given way to 70 million efficient and complex machines that have made curiosities of the buggy and the buggy horse.

A medical science that five decades ago was still struggling to throw off the superstitions of the prescientific age has given way to the miracle drugs and the beginning of a scientific approach to the subtle relationships among mind, body and environment.

The ancient dream of flight has materialized as the jet, the rocket, and the satellite. A predominantly rural way of life has given way to a decidedly urban one. And on and on.

But all this rapid development of sophisticated instruments and tools to produce new products, to tap new sources of energy, and to explore distant planets is yet far ahead of our understanding of how to deal with the traffic problems of a modern city.

Our fantastic progress in the physical sciences has not been matched by our still rather halting endeavours to deal adequately with the economic, social, and cultural changes which are ensuing.

What's more, changes occur with a breathless rapidity today. New technological accomplishments are heaped upon us so fast that they are facts of life before we have even thought to appraise what their overall impact on the conditions of life might be.

Instead, we alter our physical environment by bits and pieces with all too little concern as to the ultimate significance to man. Any one of us caught in an urban traffic jam, breathing exhaust gases, and creeping in our powerful cars at a pace slower than a man can walk must wonder occasionally at our lack of foresight.

Our natural resources are threatened now. Unless we act to protect them the situation will be much worse by 1970 when the national population will have reached 214 million and our industrial output will have doubled again.

Today one-half of our population lives on less than a tenth of the land area of the country. By 1970, two-thirds of our still larger population will live on that same limited land area.

The doubling of our industrial output together with a similar increase in research and development expenditures will produce a flood of new products and processes which are bound to create more complex problems in our urban environments.

President Kennedy is aware of the risks involved and of the importance of air as one of our primary natural resources which must be conserved. In his message to Congress on natural resources on February 23rd, 1961, he stated his intention to foster a more effective Federal programme for protection of this vital resource. He commented on air pollution both as a health hazard and as the cause of an economic loss amounting to billions of dollars annually.

The current air pollution law gives the Federal programme the role of conducting research, training and technical assistance and reserves to the States and local communities responsibility for control. I believe this is a sound approach to the problem, but, in the course of doing my homework for this address today, I observed that there are only about 100 control programmes with full-time staffs and that only 28 of these have 5 or more full-time employees.

In view of the fact that economic damage alone from air pollution is on the order of $7·5 billion a year, it is something less than heartening to learn that the total local expenditure for control of air pollution amounts to only $8 million a year and State expenditures to only $1·5 million. The picture is not brightened by the further fact that about half of these sums are spent in only one State—California.

Clearly, we are not doing anywhere near enough about the problem of air pollution in most areas of the country. It is a truism—but a disturbing one—that the problem will only get worse, building up more and more trouble for the future, unless efforts on both the local front and the national front are greatly accelerated.

The time has clearly come for the Federal Government to take a much more active role.

Though they made some mistakes, the far-sighted people who moved ahead in a practical way against the problems brought about by the original industrial revolution did not wait until they knew all the answers to all the questions before taking action for human betterment. If they had waited, some of the problems they encountered would still be with us today.

I see no reason to wait until every scientist in the country is absolutely certain that air pollution is or may be one of the causes of rising rates of lung

cancer before moving to minimize the danger.

I see no reason to wait until $7·5 billion in economic damage is raised to $15 billion before taking action.

I see no reason to wait until every city's problem is as critical as that of Los Angeles before admitting that the problem is increasing elsewhere.

The Department of Health, Education, and Welfare is giving intensive consideration to practicable ways for stepping up the attack on this mounting environmental problem.

The legislative proposal we are working on would make it possible to step up substantially our research into the sources, the nature, and the effects of air pollution and into means of obtaining better methods and instruments for abating it. It would amplify the Federal programme's capacity for assisting States, localities, and industry in the areas of technical assistance and training. As you know, however, many major sources of air pollution can be controlled by existing devices and methods.

The proposal we are considering is intended also to provide more Federal assistance to States and localities in the development and support of control programmes designed to apply the knowledge we now have. This assistance would include financial stimulation and vigorous Federal leadership to help States and communities place increased intention and resources on the problems of air pollution control.

I understand that at the present time, none of our metropolitan areas, with the exception of Los Angeles, has developed enough knowledge to relate quantitatively the quality of their air to the emissions from specific sources. We believe that new legislation will help brighten this gloomy picture considerably.

Any new Federal action we propose would not alter in any way the continuing necessity for co-operative effort among all levels of government, industry, and the public. It would not give regulatory powers to the Federal Government. On the contrary, its primary intent would be to help make the co-operative effort more fruitful.

We must all intensify our efforts. The hour is late and with the pace of change in today's technology, tomorrow is already here.

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# COUNCIL OF EUROPE

## *Report on Air Pollution*

The Social Committee of the Council of Europe has prepared and presented to the Consultative Assembly an Introductory Report on Air Pollution (Doc. 1292, April 1961). The report discusses the effects of air pollution, its sources, the European aspects of the problem, and the measures to be considered.

On the health aspects the report states that it would be desirable to increase medical and epidemiological research, notably into the correlation between air pollution and illnesses which may result, such as:

(*a*) Cancer
(*b*) Cardiac diseases
(*c*) Lung diseases
(*d*) Nervous complaints.

Discussing lung diseases, it is interesting to note that the only statistics quoted are those for England and Wales. A paragraph on " Nervous Depression "—a factor often neglected—may be quoted:

> " The psychological effects of air pollution should not be overlooked. Smoke, bad light and fog have a depressing effect, as all of us have frequently noticed in our own case. The initiative, energy and hence often the output of workers generally fall off in foggy weather. Whether there is a consequential increase in nervous depressions or even suicides is a subject that would repay study."

The discussion on the economic

effects of pollution, its sources, and preventive measures is, in general, somewhat brief and a few of the statements made would appear to be open to query) *e.g.*, " Filters and other devices can be contrived for purifying the toxic gases emitted from domestic and industrial chimneys and motor vehicles ").

We have borrowed, and would like to acknowledge, the excellent statement that opens the chapter of the report on European aspects of the problem, and have used it as a slogan at the beginning of this section of our journal. The paragraph from which it is taken is as follows:

> " Air knows no frontiers. If the source of pollution is near demarcation lines, the impurities in suspension in the atmosphere spread from one country to another. In this domain European peoples are clearly dependent on each other. Regional development plans in one State must therefore take into account the damage that the establishment of such and such an industry may cause in neighbouring countries. This raises questions of European co-operation with which the Council of Europe should deal."

More scientific research is urged, and so are measures to inform the public about the problem:

> " The advantages of collaboration at European level here are self-evident. A publicity campaign organized on a large scale would be more effective and less costly. The European communities worst affected by air pollution should press for such a campaign. Articles and pamphlets might be published in various languages, television broadcasts arranged and jointly-produced films shown."

On measures to be considered the report says that " A number of the Council's member countries have been devoting increasing attention to air pollution. But hardly any of them have specific legislation on the subject, apart from a few rules of a strictly limited character and bearing in mind, of course, the protection afforded by civil law to persons and property."

" The exception," continues the Report, " is the United Kingdom, where the 1956 Clean Air Act is a considerable legislative achievement in this field."

**Conclusions**

The conclusions reached by the Committee are as follows:

> " In the matter of air pollution, economic interests sometimes seem to be at variance with social interests. But if the problem is to be considered as a whole, if we think of the tremendous material damage caused by polluted air, especially in industrial towns, it is undoubtedly in the general interest to take action from which all will benefit, both economically and in health.
>
> " It will be necessary to lay down standards and above all to see that they are respected. The problem is a serious one, and it will become ever more serious as industrial development proceeds. No time must therefore be lost in reconciling the demands of hygiene with those of the economists.
>
> " In view of the foregoing considerations, and above all of the complexity, seriousness and international character of the problem, and the importance of the social, human and economic interests involved, the Social Committee believe that it would be advisable to convene a conference of scientists, industrialists and representatives of trade unions and the governmental organizations concerned, to enable them to pool their experiences and study means of alerting public opinion and intensifying research with a view to finding remedies.
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> " The Committee will in all probability present a draft recommendation on these lines to the Assembly at its next session."

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**California's First Approved Exhaust Device.**—California's Motor Vehicle Pollution Control Board has approved the first device for reducing smog-producing hydrocarbon emissions from autos. It is a " positive crankcase ventilation system " developed by General Motors' AC Spark Plug Div., and eliminates up to one-third of the pollutants in the blowby gases from the crankcase. It does not reduce exhaust emissions.—*Business Week, New York.*

*France*

# NEW LAW AGAINST AIR POLLUTION

We have received the text of the new French Law No. 61-842 passed on August 2nd, 1961, relating to atmospheric pollution and odours and being an amendment to the law of 19.12.1917.

In essence the law states that all dwellings and premises, vehicles or other mobile objects, must be constructed or used in such a manner as to avoid polluting the atmosphere and emitting odours which are a nuisance to the population, endanger health or public safety, harm agricultural produce, conservation of buildings and monuments or the character of beauty spots. To achieve this, regulations will be formulated by the competent authorities who will determine how the law is administered in detail. Penalties for contraventions of the law will range from fines between 2,000 and 100,000 NF and prison sentences of up to six months.

**Paris Conference Report**

We have received, as we go to press, a copy of the special issue of the journal of the Association pour la Prévention de la Pollution Atmosphérique of France. (Price 30 NF). This is the record of the 1st National Congress on Air Pollution organized by the Association and held in Paris in November, 1960. It is a stout volume of 628 pages, containing 44 papers, plus " Conclusions " by the rapporteur, M. l'Ingénieur Général Avy.

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*Germany*

# ESSEN REPORT

The Annual Report of the Technical Control Association, Essen, E.V. for 1960 gives details of research done in the field of heat and power engineering. Of particular interest are results of research on various dust removal equipment and analysis of emissions and immissions of dust and gases.

The latest journal of the Technical Control Association (1961, Vol. 1) contains reprints of papers from various German technical publications. The subjects covered include: survey of the work by Commission for Clean Air; sulphur dioxide emissions, measurements of gas concentrations in industry; and traces of combustible sulphur in oil-fired boiler plant.

*U.S.A.*

# NEW AIR MONITORING SERVICE

The establishment of a continuous air-monitoring programme to provide vital information on air-pollution levels in American cities has been announced by Surgeon General Luther L. Terry of the Public Health Service.

Designed to provide automatic measurement and analysis of the continuously fluctuating levels of pollutants in urban air, the programme is based on special air-monitoring equipment located in the centre-city area of eight major U.S. communities—Chicago, Cincinnati, Detroit, Los Angeles, New Orleans, Philadelphia, San Francisco, and Washington, D.C.

Built and equipped by the Public Health Service at a total cost of $300,000, the new equipment is now going into operation and will provide, at the outset, automatic and continuous sampling and analysis of seven gaseous pollutants—sulphur-dioxide, nitric oxide, nitrogen dioxide, carbon monoxide, ozone, total hydrocarbons, and total oxidants.

In addition to automatic gas sampler-analyzers, the stations will also house supplementary equipment to provide information on particulate

pollutant concentrations, pollutants washed out of the atmosphere by rainfall, and measurements of wind turbulance at the sampling sites.

Continuous air monitoring is not intended to supplant the periodic sampling conducted by the National Air Sampling Network of the Public Health Service, which has been in operation since 1955. The National Air Sampling Network provides information, at more than 250 urban and rural sites, on average levels of particulate matter and of radiation; and, at 50 sites, on the average levels of two gases—sulphur dioxide and oxides of nitrogen.

The new continuous-monitoring stations will be operated by employees of the participating cities, all of whom have received special training at the Public Health Service's Robert A. Taft Sanitary Engineering Centre in Cincinnati, Ohio. The first of the eight cities in which this operation began is Cincinnati, which dedicated its station on October 23rd to mark the beginning of Cleaner Air Week.

" While the National Air Sampling Network continues to be extremely valuable as a means of determining trends and changes in air pollution patterns nationally," said Vernon G. MacKenzie, Chief, Division of Air Pollution, Public Health Service, " we have for a long time needed more sharply defined information on the continuously changing levels of pollutants throughout the day and night for use in our research and epidemiological studies on the health effects of air pollution. The continuous air monitoring programme should eventually fill this need."

## MORE U.S. NEWS

### *from Arthur C. Stern*

*U.S. Public Health Service*

A symposium on the Analysis of Carcinogenic Air Pollutants was held at the Robert A. Taft Sanitary Engineering Centre in Cincinatti, Ohio, on August 29th-31st, 1961. Nineteen papers were presented and with the discussion will be published as a monograph of the National Cancer Institute.

The Division of Air Pollution, in co-operation with the California State Department of Public Health, is sponsoring a Research Conference on Motor Vehicle Exhaust Emissions and their Effects, to be held December 5th, 1961, at the Allan Hancock Foundation Auditorium, University of Southern California, Los Angeles.

In October, 1961, a co-operative project between the Edison Electric Institute and the Division of Air Pollution of the U.S. Public Health Service was initiated, entitled " Research Study on the Measurement and Evaluation of Opacity of Plumes from Stacks of Steam Electric Power Plants." The purpose of the project is to investigate the fundamental aspects of opacity and to determine a means of measuring objectively the opacity of industrial stack emissions, and to relate subjective measurements to instrumental techniques of evaluation.

Several governmental committees have prepared important reports relating to air pollution during this quarter. It is expected that these reports will be released in the next quarter. I will include discussion of them at the appropriate time.

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**1953 Smog Cause**

Between 170 and 260 New Yorkers died as a result of ten days of heavy smog in November, 1953. A study by Dr. Leonard Greenburg, an air pollution expert, shows the smog was caused by a high concentration of soot, dust and sulphur dioxide which drifted from the industrial regions of Pennsylvania and Ohio.—*Daily Telegraph.*

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In Los Angeles a 68-year-old retired builder threw himself to death from his 12th floor flat to escape the smog. Police said he left a note that " smog-affected lungs made life too miserable."

# *Smoke Control and the Coal Trade*

## Minister's Frank Words

Dr. Charles Hill, Minister of Housing and Local Government, told the Coal Industry Society in London at a luncheon on November 6th that coal merchants were not likely to encourage householders in prospective smoke control areas to stick to solid fuels by giving the impression that premium smokeless fuels were expensive and scarce and coke unsatisfactory. In his view implementation of the Clean Air Act was a challenge, not a threat, to the industry.

The Minister continued: " Premium smokeless fuels are of course excellent. But they are not, and never will be, the complete answer. Increased production will be most helpful to my smoke control work—and let me say here that I shall be watching with the keenest interest the progress of the National Coal Board's work at Birch Coppice—but in the most favourable circumstances cannot be expected to match up to the enormous expansion of smoke control in the next decade.

" And quite apart from questions of availability, it would be wrong to regard premium fuels as the final solution. They are relatively expensive. Not every householder in a smoke control area will want to pay that much for solid fuel, any more than every one orders the best quality of house coal.

" Coke is actually, as all of us here know, a satisfactory and economical fuel for the open fire in the home. Tens or hundreds of thousands of people use it in open fires outside smoke control areas not because they have to but because they like it.

" I suggest that the fundamental problem which smoke control sets the coal industry is how to combat and overcome the unfounded prejudice against coke which is still only too common. This problem will have to be tackled and solved if the coal industry is not going to be handicapped in its efforts to retain for solid fuel a proper share of the changed domestic markets in smoke control areas. There are many different facets of this problem. A satisfied consumer is the objective."

Dr. Hill, who was analysing the effect of smoke control on the coal industry, said that there was a marked tendency among householders and industrialists to modernize their fuel-burning appliances. People were better off and wanted to be more comfortable. " The days of the icy January bedroom, once regarded as part of the British way of life and a symbol of national manliness, are numbered," he said.

Dealing with the variety of heating methods and appliances available to the consumer—solid fuel, gas, electricity and oil—the Minister went on: " So long as the fuel he chooses is a smokeless solid fuel, he remains a supporter of the coal industry.

" The coal industry of course have adjustments to make too. The raw coal has to be turned into a manufactured smokeless fuel for him, and his distributor delivers a different article. No doubt adjustment of that sort gives the industry difficulties of various kinds, some easier to surmount and some harder, but they retain their customer.

" But if the householder switches over to gas, electricity or oil, then he ceases to be a customer of his distributor. He does not necessarily cease to be a customer of the coal

industry, since the odds are that his gas or electricity comes at one remove from coal, but the distributive side of the industry loses him.

" Perhaps the householder who switches over to gas, electricity or oil when a smoke control order is made knows exactly what he wants and would sooner or later have made the change, just as householders outside smoke control areas make the same change without any compulsion to stop using coal. In that case there may not be much that the distributive side of the industry can do to retain him as a customer.

" But when a smoke control order is made there must be a great many householders who have no very fixed or firm views about the type of appliance and type of fuel that will best meet their requirements when they stop using coal, and these seem to me the people with whom the coal industry are most vitally concerned when smoke control is about to be introduced in any area.

" May I be frank? I believe that some sections of the coal trade have to set their house in order here. There have been occasions when the coal trade have gone out of their way to give the impression in a prospective smoke control area that raw coal is best, that premium smokeless fuels are indeed good but are in short supply and expensive, and that coke is an unsatisfactory alternative to coal. That is not likely to encourage householders to stick to solid fuel. Are they not much more likely, on hearing these gloomy statements by their regular suppliers, to think hard about abandoning the use of solid fuels?

" On the contrary, the industry should in their own interests do everything they can to dispel out-of-date prejudices about coke as an open-fire fuel."

Earlier in his speech, speaking of the progress of smoke control, Dr. Hill said: " In the next decade—not to look further ahead—the main spread of smoke control will be in the ' black areas '.

" My predecessor asked local authorities in the black areas of England and Wales to draw up smoke control programmes for their districts. It is a great pity to have to say that quite a number of the authorities failed to respond, but even so the total number of premises covered by the programmes was very nearly six million.

" That is a formidable total. It cannot be questioned that fulfilment of these programmes—and fulfilled they must be, as quickly as possible—will affect traditional patterns in the coal industry."

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**Warwickshire Clean Air Council**

The Council's Report for 1960-1 is an informative document. Considerable and varied activities are reported and the results of atmospheric pollution observations in the county are given in detail. The Council, which is a joint committee of local authorities, has assumed responsibility for these measurements and their analysis, thus securing co-ordination and planning, the cost of which is met by contributions from the constituent authorities. The annual income of the Council is about £3,000, the greater part of which is expended in these operating costs. Useful technical appendices are reports on the ignition of smokeless fuel by electricity and on the cost and availability of smokeless fuel in the county. The report is to be commended for its practical and purposeful nature. A further activity to which it refers is discussed in an editorial note on page 105.

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**Mrs. 1870**

How I dread the smokeless zone coming to this area. My husband and I like our coal fire and I enjoy having the sweep, going in the garden and watching his brush pop up through the chimney, and afterwards having a cup of tea with him and smelling that clean smell of wholesome soot. It's a joy!—*Letter in the " Evening News."*

# *Gas Men in Conference*

## Industry's Optimism

THE Gas Industry's "Sales and Service" conference, at Harrogate in November, attended by 600 senior officers from all parts of the country, had much to interest the clean air movement. Particularly impressive was the upsurge of confidence and optimism for the future that was most evident. We can welcome this, just as we welcome progress made by other contributors to smokeless air. Competitors though they may be, they have, from our point of view a vast field for a common advance, and as far as gas is concerned it should be able to play a much bigger part in the development of smoke control areas than has perhaps been realized—even in the industry itself. Our one regret was that the importance of this opportunity, made possible by changes in the industry, was barely mentioned at the conference.

Brief reference is made in an editorial note on another page to the potential importance, in the expansion of smoke control areas, of cheaper gas and more efficient, more attractive, appliances. The smoke control area market has as yet been barely opened up (less than one-eighth of the most forward region, the County of London), and progress will be faster and more certain if *all* the smokeless methods can share it more equally.

There is, of course, fierce competition for the new and growing central heating market (and here coal comes in as well as electricity, gas and oil), but from our point of view this is at present only a marginal development. It is the millions of individual room heating appliances in the black areas that have to be considered if smoke control is to be speeded up. For giving an idea of the share that might be taken up by gas the Harrogate conference was of considerable importance. It was, to begin with, encouraging to see the figures and progress diagrams in a printed paper by W. K. Hutchinson, Deputy Chairman of the Gas Council, showing in particular the remarkable rise in the sale of gas space heaters since 1957—namely from 123,000 in that year to 265,000 last year. Boilers for central heating and warm air units also show impressive growth. This was followed by a paper on "The Domestic Space Heating Market," by A. F. Hetherington, Chairman of the Southern Gas Board. Much of this was of course addressed to those inside the industry, but some passages were of wider interest.

Thus Mr. Hetherington said: "The post-war years have seen a domestic revolution. People are earning more, owning more than ever before. With social life now centred on the television set there is far greater demand for comfort, convenience and appearance in the home. People are at last beginning to tire of the dirt and labour of the coal fire and its pollution of the atmosphere. The importance of all this to the gas industry cannot be overstated. With therms per customer falling rapidly, we were in dire need of a new market. Now we have one—and a really big one—in the replacement of the coal fire and in the supply of a full heat service to those who can afford it. We have tough and energetic competitors in electricity and oil—but with first-class appliances, attractive tariffs and improved gas we are well equipped to fight our way into the "space heating age." Our main obstacle perhaps is still the inertia of the users of raw coal, many of whom think it old-fashioned, expensive and dirty—but have not yet come round to making the inevitable change."

We heartily agree with this last sentence—and would add that inertia can be overcome by the right kind of

pressure, and that smoke control areas are increasingly applying that pressure.

**Fumes**

Later Mr. Hetherington discussed the bogey of fumes, which every speaker on clean air gets thrown up at him at question time. After considering the financial deterrents to space heater sales he said:

" There is, I think, another major inhibiting factor. I believe that the matter of ' fumes ' is dominant in many potential customers' minds. They do not always mean products of combustion. Sometimes they mean a smell of gas, sometimes a dry, stuffy or unhealthy atmosphere. The gas heater is still widely held to be bad for chesty people, to kill house plants and even to need a bowl of water. This is ridiculous nonsense but we must face the fact that many people believe it.

" The adverse public image, derived mainly from the appliances of former days, will have to be broken down quickly. If people simply do not like the idea of being in a gas-heated room, most of our sales effort will be wasted on them. I think we should distinguish here between ' cleanness ' and ' freshness.' People know our heaters are ' clean '; by this they mean that, unlike the coal fire, they do not cause dirt. ' Freshness ' is perhaps the word most directly opposed to the present image of gas heating. This, in my opinion, is the attribute we should claim most strongly for the modern gas heater. The new feature of ventilation control should help us to do so."

We are glad, from the clean air viewpoint, that Mr. Hetherington added: " Our old association with ' fumes ' must not be perpetuated by the sale of portables in situations for which they are unsuited—and the sooner we sell balanced flue heaters instead of radiators, the better it will be for our image.

**Warm Air**

" Many experts believe," said Mr. Hetherington, " that our long-term future is in the warm air installation. They point to North America, where, they say, piped water central heating is already considered to be old-fashioned. The low capital cost of selective warm air installations, greater flexibility and the absence of unsightly radiators and piping are also stressed together with the possibility of filtering our house dust. Improved fans may lead to smaller ducting and easier installation in both new and existing premises."

To the clean air observer this paper and the full and varied discussion that followed, was instructive and encouraging—encouraging in the sense that this old ally of the clean air movement was confident about the bigger part it was going to play in the future. As one speaker neatly put it " It is old-fashioned to believe that gas is old-fashioned."

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**Underfloor Heating**

The monthly journal *Heating* has published in the form of a booklet (6s., from the publishers, John D. Troup Ltd., 90 High Holborn, London, W.C.1) a series of articles that it recently published on " The Design and Installation of Electrically-warmed Floors ". The author is Leslie Shepherd, B.SC.(Eng.), M.I.E.E., and the four articles will be found to be of much practical guidance to all who are concerned with the " know how " of this important new method of space-heating for domestic and other premises. The articles are well-illustrated.

**Clean Air for Royal Courts of Justice**

The Ministry of Works has just completed the first phase of the extension and modernization of the heating and electrical systems in the Royal Courts of Justice in the Strand. It has included the replacement by central heating radiators of about 380 open fireplaces in judges' rooms and offices, which had become necessary because the City Council in 1958 declared this part of Westminster to be a smoke control area.



## In Cleaner Glasgow

*A roof garden scene on top of Merchants' House, George Square, now in a smoke control area. Photograph by the courtesy of "The Glasgow Herald."*

*(Note: More photographs of the kind and quality are invited.*—ED.)

# AIR POLLUTION ABSTRACTS

## ABSTRACTS OF PAPERS PRESENTED AT NSCA ANNUAL CONFERENCE, BRIGHTON 1961

**559. Operation of the Clean Air Act: Local Authority Viewpoint.** Batey, J. W. (Proc. NSCA Conf. Brighton, 1961). The paper reviews the Act section by section, assessing their value or shortcomings in practice. It is concluded that the Act is proving a useful tool in combating smoke. It could be strengthened most effectively by improving section 5, which deals with grit and dust from chimneys.

**560. Manufacturing Industry and the Clean Air Act.** Dickie, W. J. (Proc. NSCA Conf. Brighton, 1961). The author describes the approach of industry to the Act, and states that strenuous efforts have been made to comply with its requirements, with a marked improvement, despite high cost. The lead and assistance given by the Federation of British Industries, of which the author is Technical Officer, are described, and difficulties encountered are discussed. The paper continues by describing the progress made in several important industries: glass, heavy clay and refractories, pottery, chemicals, iron and steel. In conclusion it is stated that " industry is answering the challenge of pollution in a vigorous and determined manner."

**561. Fuel Efficiency and the Clean Air Act.** Opie, C. M. (Proc. NSCA Conf. Brighton, 1961). The promotion of clean air and compliance with the Clean Air Act through attention to fuel efficiency, is discussed, with particular reference to the work of the National Industrial Fuel Efficiency Service. Sections include boiler plant, grit and dust emission, training and education of boiler operators, prior approval, height of chimneys and mechanical firing. Ways for accelerating progress in the industrial field are outlined: (1) recognition of stoking as a skilled job, with firemen properly trained, certificated and remunerated. (2) Active co-operation between industry and their trade associations to carry out surveys and promote application of existing knowledge. (3) Steps to promote greater uniformity of application of the Act throughout the country.

**562. Boiler Plant Design and Equipment and the Clean Air Act.** Webber, A. F. (Proc. NSCA Conf. Brighton, 1961). The prevention of smoke, grit and dust, and acid smuts, is discussed from the practical aspects of plant design and equipment and other factors, including instrumentation and chimney heights. The problems for new installations and for existing installations are considered separately. It is concluded that smoke emission is quite unnecessary and can be eliminated at source. There is no difficulty in locating an offending chimney, but this may be difficult for grit emission. In such cases tests should be made on the actual grit content of the flue gases. The emission of $SO_2$ and really fine dust is difficult to bring home to any particular chimney.

**563. Solid Smokeless Fuels Position, The.** Baird, D. E. (Proc. NSCA Conf. Brighton, 1961). The author analyses the natural and manufactured fuels falling under the description of Solid Smokeless Fuels and surveys their supply position. Plans are being made by the producers to meet future requirements and the availability of suitable fuels should not be a pretext for local authorities to delay with smoke control areas. The paper comments on consumer choice both as regards fuels and appliances and concludes that the public wants clean air but that householders have much to learn how to burn smokeless fuels.

**564. The National Survey of Air Pollution.** Clifton, M., Craxford, S. R., and Weatherley, L. P. M. (Proc. NSCA Conf. Brighton, 1961). Description of the new scientific national survey of air pollution planned by the Warren Spring Laboratory with the co-operation of 120 local authorities selected so as to give a representative cross-section of the pollution levels throughout the country. Daily measurements with recently-developed instruments are being taken of $SO_2$ and smoke suspended in the air and not by deposit gauges as formerly.

**565. Whole-House Heating Systems.** Shaw, W. F. B. (Proc. NSCA Conf. Brighton, 1961). The systems and equipment suitable for heating of family dwellings are discussed. Methods for

whole-house heating have the advantage of being practically smokeless and so contribute to clean air. The author describes the three main central heating systems and considers the capital and running costs of various fuels which can be used. There is also a detailed description of various central heating appliances.

**566. Operation of the Clean Air Act: Smoke Control Areas. Why such Slow Progress?** Herrick, G. W. (Proc. NSCA Conf. Brighton, 1961). The author surveys progress of smoke control areas under the Clean Air Act and considers it disappointing. He points out tne failure of 115 local authorities in England and Wales to submit any programmes by March 31st, 1960, and comments on the very varied rate of progress in different regions. Positive approach to the problem is advocated and comment made on public reactions, especially in author's borough of Fulham where the householders were found to be reasonable and where the conversion of old fireplaces proved less costly than anticipated. The author suggests a systematic approach and queries whether some Councils have enough experience to dispense with the survey stage.

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## GENERAL ABSTRACTS

**567. Smoke Abatement.** British Ceramic Research Ass. (Stoke-on-Trent: The Association, December 1960, 13th Annual Report, 26). A brief description is given of work carried out in connection with the Clean Air Act, and in particular with the problems connected with the firing of blue engineering bricks and salt glazed pipes. (DSIR).

**568. Increase of Air Pollution in Mexico City.** (In Spanish) Jauregui, E. O. Ingenieria hidr. en Mexico, 1958, **12,** (4), 9-18; abstr. in Met. Abs., Feb. 1961, **12,** 291). Since the population of Mexico City has more than doubled between 1940 and 1957, the amount of atmospheric pollution and reduced visibility has become serious. The pollution is not dirt and dust borne by the wind, since it is present at all times and especially heavy in the calm morning hours. Conditions are compared with those in other countries. Diurnal visibilities (to NE) from Tacubaya 1935-39 and 1950-54 are shown comparatively for spring and winter. (DSIR).

**569. Control of Dust.** Parkes, W. B. (Ironfndng. Hlth. and Safety, 1960, 39-46; abstr. in Jour. Iron Steel Inst., July 1961, **198,** (3), 305). The standards employed in South Wales, in France, and by the International Labour Organization at Geneva are examined and a plea for one standard is made. The methods of collecting and measuring the dust are discussed. It is implied by both the French and Geneva recommendations that silica is the only dangerous constituent in the dust and this is reviewed in relation to other industries outside the foundry. The reduction in airborne dust is examined at some length. (DSIR).

**570. The Problem of Maintaining Clean Air, with special reference to the Operation of Iron Foundries and, particularly, steelworks.** (In German) Guthmann, K. (Radex-Rundschau, 1961, (1), 449-484; Abstr. in Aufbereit.—Tech., Aug. 1961, **2,** 343). Legal definitions of maximum allowable concentrations in the U.S.A., France, the Netherlands, the Soviet Union, Great Britain, Austria, Belgium, Italy, Switzerland, Sweden and the Federal German Republic are given. The work of the VDI-Kommission Reinhaltung der Luft is explained. The present position and possible future results of dust removal and gas purifying equipment in iron foundries are reviewed and the cleaning of blast furnace gas and waste gases from sintering and from Siemens-Martin furnaces and flue-gases from Thomas converters is discussed. The problem of removal of brown smoke from LD-crucibles and small Bessemer converters in steelworks is examined. (DSIR).

**571. Survey of Russian Literature on Air Pollution and Related Occupational Diseases. 5.** Levine, B. S. (Washington: U.S. Dept. of Commerce, Off. Tech. Serv., 1961; rev. in Jour. Air Pollut. Contr. Ass., Aug. 1961, **11,** 393). This latest survey of the Soviet literature contains translations of 54 articles in six sections dealing with: Russian studies of limits of allowable concentration; pharmacological, toxicological and clinical data, industrial sanitation, ionisation and ultraviolet radiation; benzpyrene, and analytical techniques for measuring various pollutants. (DSIR).

**572. On the Part of Cement Dust in Atmospheric Pollution and in the Respiratory Pathology.** (In Italian) Mazzetti, G. Signorini, L. F. and Sannini, T. (Lavoro umano, 1961, **13,** 1). After a general discussion of the problems connected with

the atmospheric pollution from cement dust, the authors consider the difficulties existing in the field of the epidemiological investigation, as they result from the specific literature. In an attempt to contribute towards a clarification of the problem, they have analysed the statistical data of general mortality and of mortality for respiratory diseases, during the last years, in three small communities near three cement factories, by comparing these with three other small communities, as control, living in villages without cement works. The results do not demonstrate any significant increase in the statistical indexes, but the authors consider communities too small and the periods devoted to the research too short.

**573. Use of Indexes of Air Pollution Potential in Mortality Studies.** Schiffman, R. and Landau, E. (Jour. Air Pollut. Contr. Ass., Aug. 1961, **11,** 384-386). The use of indexes prepared by the Air Pollution Medical Programme in the United States is described. The indexes are based on potential sources of air pollution, such as home heating methods, specific and non-specific industry, service station sales, etc. The relationships of certain air pollution indexes with mortality from selected diseases are examined and positive relationships are shown to exist. 3 references. (DSIR).

**574. Effects of High Volatile Fuel on Incinerator Effluents.** Stenburg, R. L. *et al.* (Jour. Air Pollut. Contr. Ass., Aug. 1961, **11,** 376-383). Tests carried out demonstrate the difficulty of burning a high volatile solid waste material without making appreciable contributions to atmospheric pollution. The extent to which operational factors affect emissions of different pollutants is emphasised by the wide range of results obtained. The logical conclusion drawn is that minimization of pollutants cannot be achieved by proper incinerator design alone but must depend on a combination of good design and proper operational procedures. (DSIR).

**575. The Effect of Atmospheric Pollution in Beroun and Kraluv Dvur on the Health of Children.** Symon, K. *et al.* (Csl. Hyg., 1960, **5,** 88-100; PHE Abs., 1961, **41,** (6), 2.) A report is presented of the results of two years' observations in the towns of Beroun and Kraluv Dvur, which are strongly polluted by smoke. In a selected group of children aged 2-13 years, the state of health, development, red blood picture, serum proteins and alkaline phosphatase were investigated. A group of children of the same age from the neighbouring, smokeless settlement Nizbor, was used as control. It was shown that pollution of the air with smoke affects the health of the children, as appears clearly from their morbidity as well as from other selected indicators. It is therefore emphasized that the use of suitably selected indicators can supplement, and to a certain extent substitute methods used hitherto for the investigation of morbidity as indicators of the influence of atmospheric pollution on the health of children. The results obtained here constitute strong argument for planned sanitary measures. (DSIR).

**576. The measurement and Alleviation of Air Pollution.** Jackson, R. (Trans. Inst. Engrs.-in-Charge, Aug. 1960, **66,** 99-134). The relevant sections of the Clean Air Act are discussed in relation to type of emission, measurement of each type, and the limits to be observed. Measurement of smoke, grit and dust is explained; the methods are studied with regard to the requirements of routine operational control. The causes of pollution are examined, and two techniques of reducing pollution are considered: (*a*) the improvement of operating practice to reduce the production of pollutants, and (*b*) the removal of pollutants from the exit gases. The measurement and removal of gaseous pollutants are not dealt with. (DSIR).

**577. Air Pollution and Chest Disease.** Hamill, P. V. V. (Diseases of Chest, May 1961, **39,** 477-84). Acute smog disasters have made it clear that air pollution can cause disease and death. The subtle effects of everyday air pollution are, however, less well known and present a formidable challenge to medical researchers. Statistical correlations based on morbidity and mortality and on laboratory studies, constitute the two main directions taken to determine long-term health effects. Neither approach yields results comparable to those which might be expected from long-term, well controlled, prospective epidemiologic studies from which all variables except the air breathed would be eliminated. A large-scale community health study in Nashville, Tennessee, by the Public Health Service represents the first venture in this field. Morbidity and mortality findings will be correlated with information from an elaborate air sampling network, while other environmental and cultural factors

are standardized. But studies much more elaborate than the Nashville study are needed. In the meantime, the need for refined portable pulmonary function instrumentation and for more accurate definition of the disease spectrum under question (asthma, chronic bronchitis, emphysema) are so crucial as to threaten serious delays. (Author's Abstract). (APCA).

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**Epidemiological Studies of Atmospheric Pollution: A Review of British Methodology.** This is the title of the reprint of a paper from the Monthly Bulletin of the Ministry of Health and the Public Health Laboratory Service (1961, 20, 2), by A. E. Martin, M.D., D.P.H. of the Ministry of Health. It is based on a paper to the W.H.O. conference on this subject at Copenhagen last year. The paper reviews the correlations and the methods used for determining them, between atmospheric pollution and mortality and, separately, morbidity. The assessment of delayed effects, short term and long term, is also discussed. This is an important contribution to the study and understanding of the evaluation of statistical material on the effects of pollution upon human health.

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**Brickworks Valley**

This is the name given to the shallow valley which runs S.S.W. of the town of Bedford, and which contains a number of brickworks along a seven-mile stretch. There have been many complaints of fumes along the valley and a report has been made of an investigation carried out for the Bedford County Council Health Department. Two investigations are in fact included: one on the measurement of the pollution in the valley, by Dr. H. S. Bury, and the other by Dr. Margaret Brothwood on a clinical investigation on the respiratory state of persons aged 45-64 in the area.

The observations on pollution show that as far as sulphur gases are concerned the situation in the area may be compared with that of a small industrial town, but as regards smoke (including grit and ash) the area is very little different from any rural area. The clinical investigation finds differences of respiratory health in different localities, but smoking habits complicate assessments.

The report does not deal, except by references in the introduction, with the effects of fluorine present in brickworks' emissions, which may be the most serious pollutant of all in the valley. No harmful effects on human beings have been found, or are thought to be likely, although " the matter is not absolutely free from doubt ". Quotations are given on the much more certain harmful effects on livestock and vegetation.

Thus in a 1957 report of the Veterinary Research Laboratory of the Ministry of Agriculture and Fisheries it was stated:

" The evidence from the Bedford brickfield shows that the typical clinical signs of fluorosis occur in the livestock. Analytical data show the presence of fluorine in amounts high enough to be deleterious to animal health. There can be no doubt that damaging fluorosis occurs in the Bedford brickfield."

The effect of fluoride deposits on the herbage eaten by cattle was clearly established in the well-known Fort William case, and we would refer to the short press report on fluorine poisoning of livestock in this area that was quoted in our Summer, 1961, issue (p. 262), with a photograph of a cow showing the typical malformation symptoms of fluorosis.

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**New Catalyst**

There is news from New York of a catalyst developed by W. R. Grace & Co. to control smog from motor exhausts. The culmination of more than two years' research, this catalyst has been used with a reactor muffler system, built by Norris-Thermador, Los Angeles, in road tests for more than 25,000 miles. The catalyst is said to reduce greatly both the smog-causing hydrocarbons and carbon monoxide when substituted for the standard muffler in the exhaust system.

### Gas Cleaning News

Lodge Cottrell Ltd. announce that they are supplying the mechanical arrestors and electrostatic precipitators for four 350 MW boilers at the Tilbury Power Station, as well as the precipitators for the new 2,000 MW West Burton Power Station near Nottingham. The latter order is valued at nearly £1,500,000 and is the largest single order for boiler flue dust precipitators ever recorded by the Company. The same firm is also to supply Dorman Long with a further four precipitators for their Lackenby steel plant oxygen-blown open hearth steel furnaces.

Steel Peech and Tozer (branch of the United Steel Companies) are replacing (at a £10 m. cost) all existing open hearth steel melting furnaces by six 110-ton oxygen-lanced electric arc furnaces. W. C. Holmes Ltd. are to supply gas cleaning plant for each of the first two furnaces to be installed at Templeborough Works.

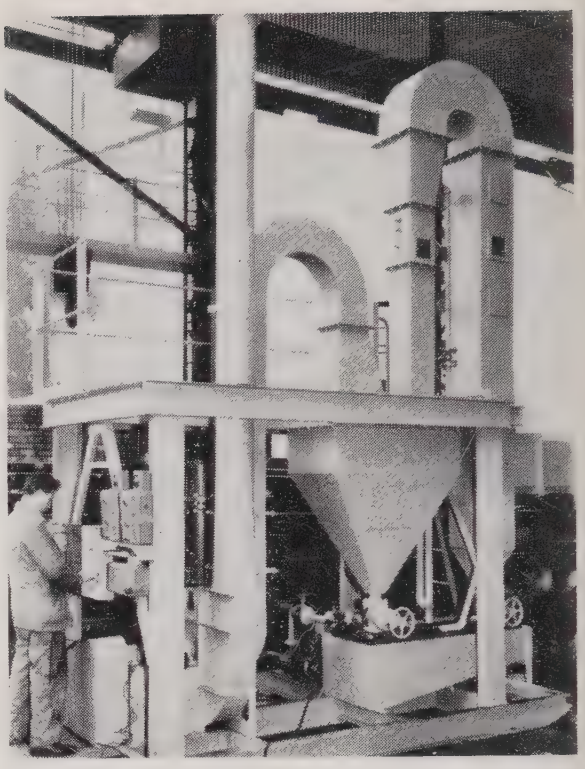
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### Carbon Monoxide Detector

A simple visual detector for this dangerous gas has been developed by the State Crime Detection Laboratory at Aalborg, Denmark. It consists of a small yellow plastic plate, which can be hung in an enclosure to be checked, or carried as a lapel badge by workers exposed to the hazard. The plates carried a circular insert containing palladium chloride suspended in a silica gel. In the presence of carbon monoxide, this turns dark in colour. The change takes about 15 minutes to become detectable in a concentration of CO of 0·01 per cent and is practically instantaneous with a 0·05 per cent. concentration. By exposure to air free from CO the detector can be regenerated for re-use. It is available in the U.K. from Messrs. Herzbi Ltd., 57 Lordship Park, London, N.16.

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*Correction.*—In the article " Parallel Paths" in our last issue, the statement made on page 48, five lines from the bottom of the first column, should have read: " In the nineteen-sixties, 68,000 people die yearly of respiratory disease, 29,000 of them from bronchitis caused largely by air pollution."



*New portable pilot plant to be used by Ambuco Ltd. to establish optimum working conditions for their Venturi Scrubbers for the removal of dust from industrial fumes*

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**Mr. F. L. Waring,** Managing Director of the " Coalite " Group of Companies, has been elected Deputy Chairman of the Group.

---

### Cleaner Air in London

The annual report of the Scientific Adviser, Public Health Department, London County Council, has been received. There is a remarkable amount of scientific work, all relating to public health, recorded in the report, one section of which deals with air pollution. It is stated that the steady reduction in the smoke pollution of London, noted since the inception of the Clean Air Act in 1957, has continued. The average concentration of smoke during the year was 30 per cent. below the levels of 1955 and 1956, with a 35 per cent. reduction during the winter months. The reduction in sulphur dioxide was less, being 10 per cent. over the year and 15 per cent during the winter months.

### Smoke and Lung Cancer

A report published in the journal *Medical Proceedings*, of South Africa, finds that although South Africans are the heaviest cigarette smokers in the world, their chances of contracting lung cancer are less than half those of smokers in the more industrialized and smoky cities of Europe. The report says: "The attempt to blame everything on the cigarette has clearly been a vast over-simplification of a complex problem. The protagonists of cigarette smoking as a cause of lung cancer have steadily been forced to shift their ground and to recognize the importance (if not the overshadowing importance) of air pollutants other than those due to cigarette smoke."

People who emigrate to South Africa from Europe are far more likely to contract lung cancer than the local inhabitants. The lung cancer death rate among British immigrants living in Durban is the highest of all groups in the country.

### Flight from Smog

According to a medical survey, reported in the *Washington Post*, the Los Angeles smog problem has caused physicians to advise more than 10,000 people to leave the area in recent years, and about 2,500 have done so. Nearly one-third of the physicians taking part in the survey have themselves considered leaving the area because of the smog.

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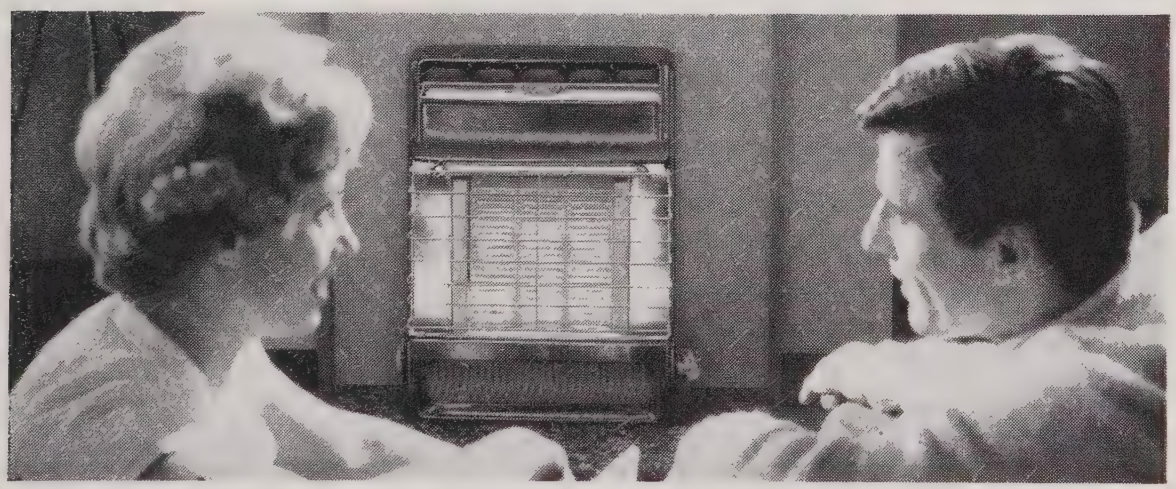
### William Hobson Andrew

We regret to record the death of one of the Society's most long-standing members, Mr. W. H. Andrew of Ashton-under-Lyne. He was Governing Director and Managing Editor of the *Ashton-under-Lyne Reporter* and its group of weekly newspapers.

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The Newark (California) Chamber of Commerce approved a resolution endorsing "Cleaner Air Week" and voted to send a copy of its resolution to Mr. Krushchev.

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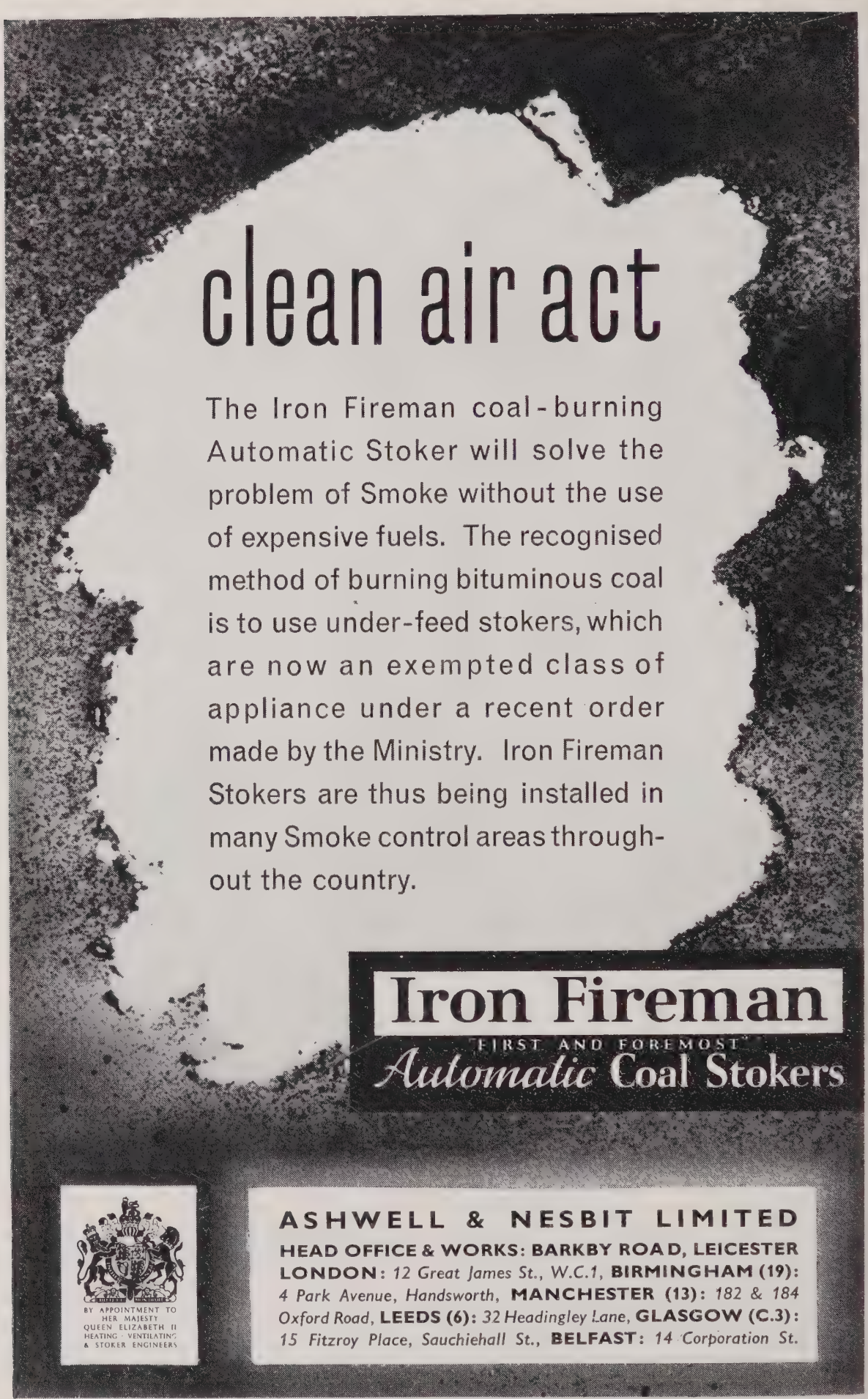


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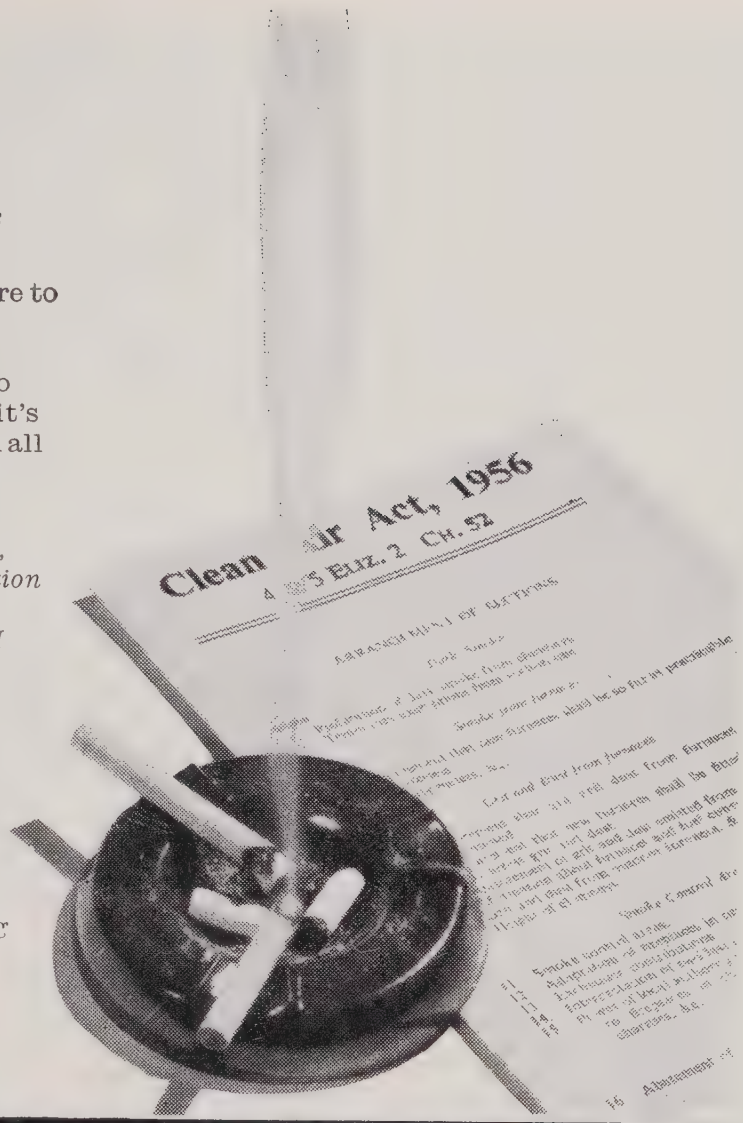

clean air act
The Iron Fireman coal-burning Automatic Stoker will solve the problem of Smoke without the use of expensive fuels. The recognised method of burning bituminous coal is to use under-feed stokers, which are now an exempted class of appliance under a recent order made by the Ministry. Iron Fireman Stokers are thus being installed in many Smoke control areas throughout the country.
Iron Fireman
"FIRST AND FOREMOST"
Automatic Coal Stokers
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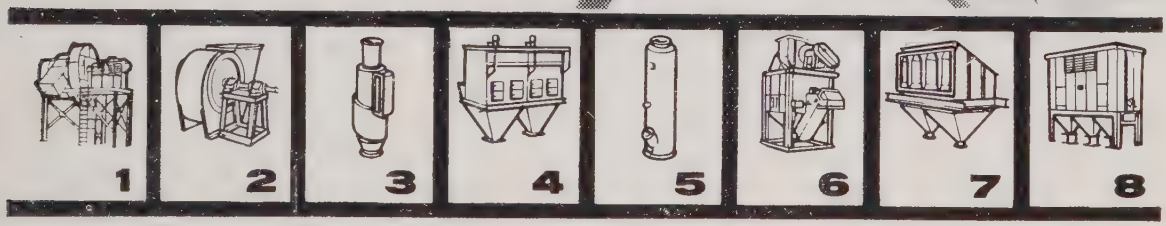
*"What do you mean—everyone's getting into the Act?"*

"I mean the Clean Air Act is here to stay. Every bit of combustion equipment manufactured and erected *now* must be designed to comply with the law—whether it's in a smokeless zone or not—and all existing equipment will need to comply by 1963."

*"I think it's a good thing because, apart from the atmospheric pollution it's making people think—about efficient combustion. That's why I say we should get in touch with Keith Blackman. They have a complete range . . . mechanical draught fans, dust collectors, combined induced draught and grit arresting fans . . . the answer to practically every problem inherent in the Act."*

"Well, they should know a thing or two. They've been at it for three quarters of a century — long before the Clean Air Act was even heard of."




*Please ask us for detailed descriptive literature on any item of equipment that interests you.*

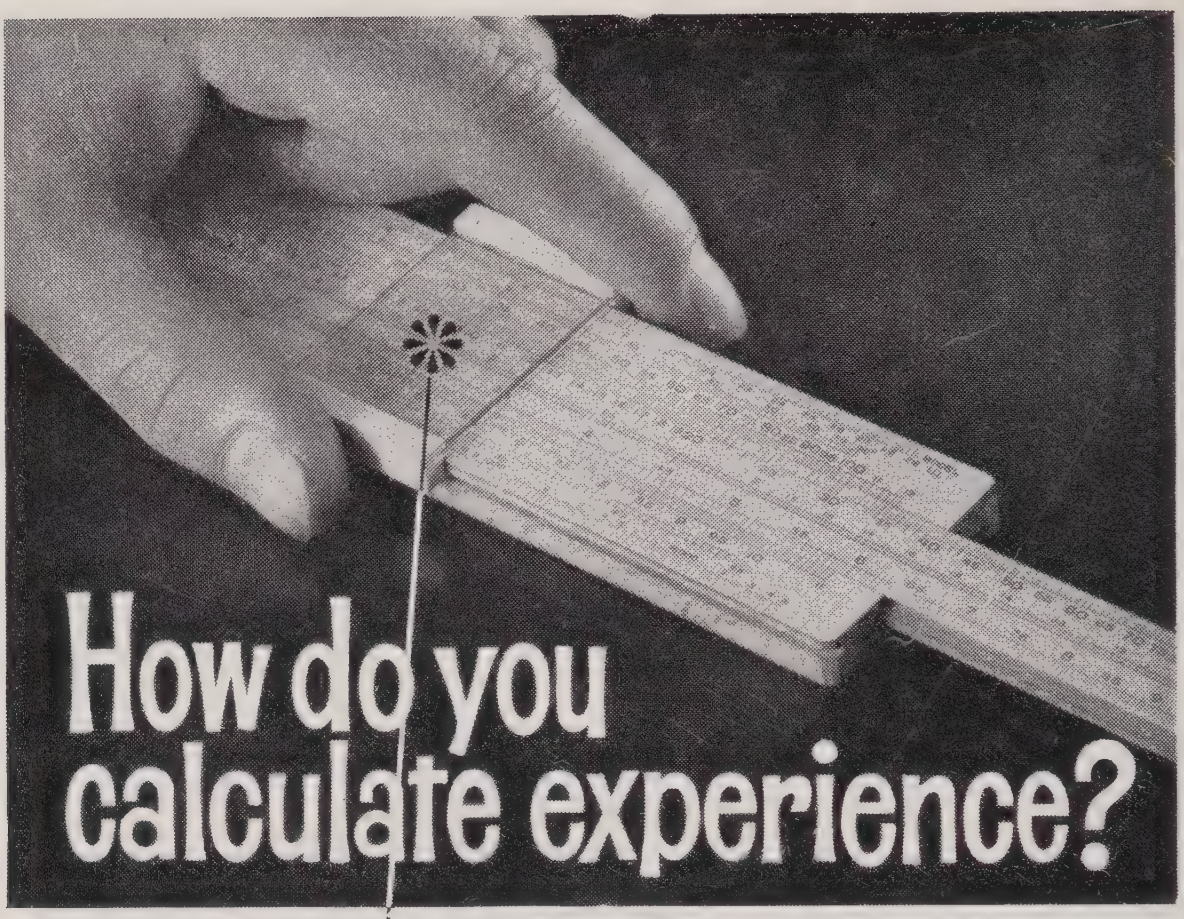
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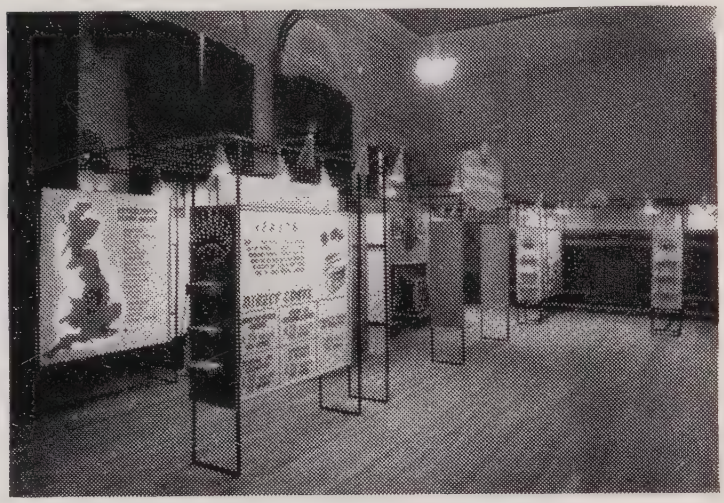
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*S.S.F.F. Exhibition Stand displayi ng approved solid smokeless fuel appliances under fire and the full range of authorised fuels*



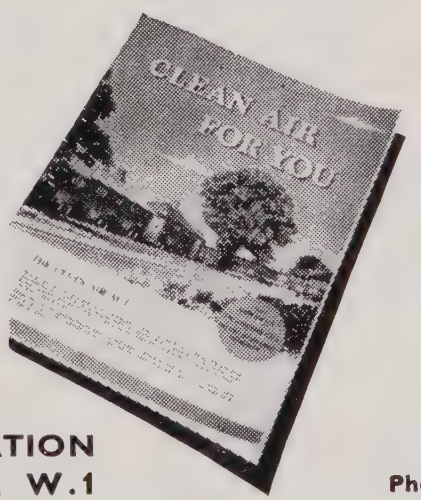



*S.S.F.F. Mobile exhibition unit displaying approved solid smokeless fuel appliances under fire and the ful range of authorised fuels*

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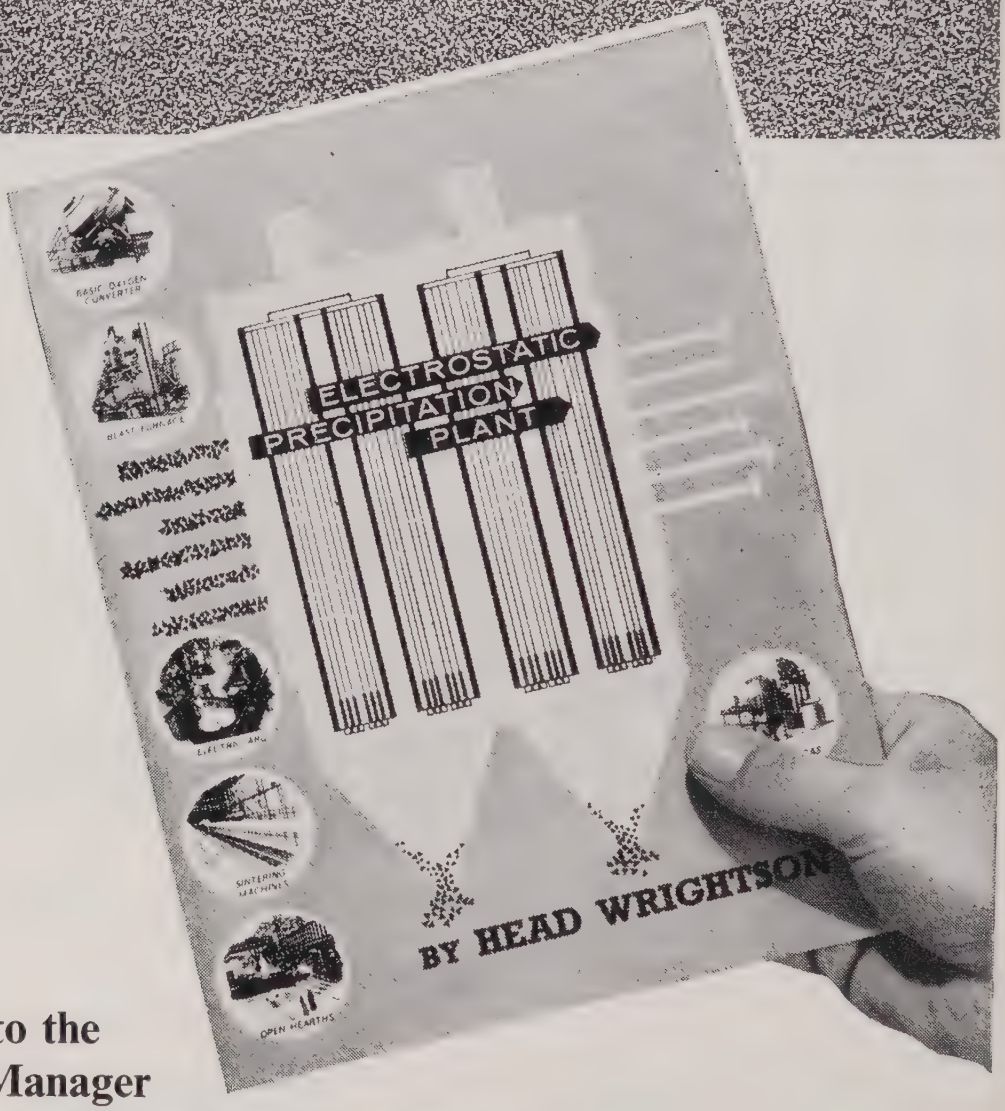
This deals with the Clean Air Act, explaining its provisions and how it must be implemented. There are publications describing modern approved appliances to comply with the Act and how to get the best out of them and on the authorised solid smokeless fuels and their application. For specimens or for further information apply to:




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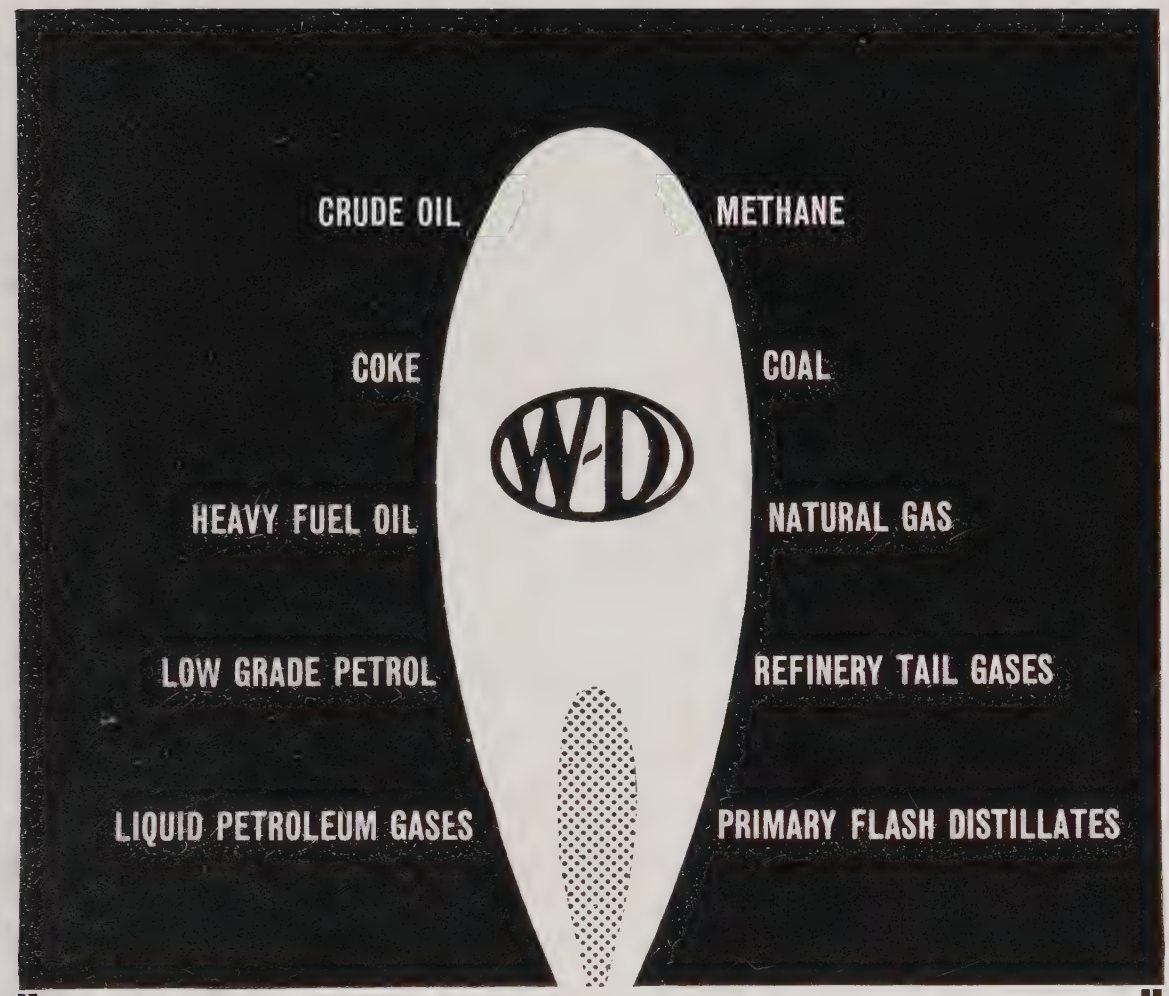
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JOURNAL OF THE
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*In this Issue*

New Ministry Circulars ★ Portrait of the Society ★ A Vertical Steam Generator ★ Automobile Pollution in California ★ The Dispersion of Air Pollution ★ etc., etc.



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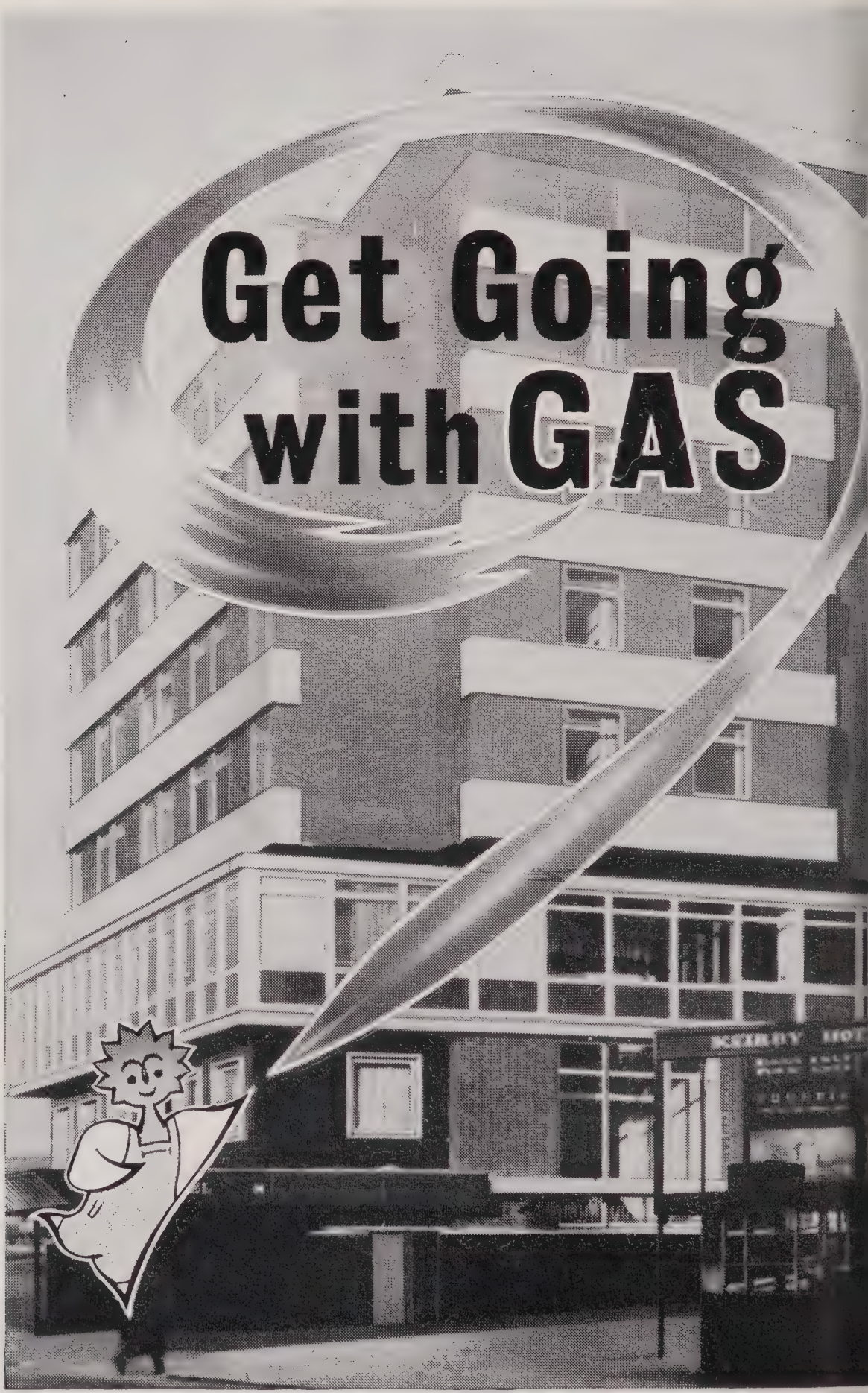

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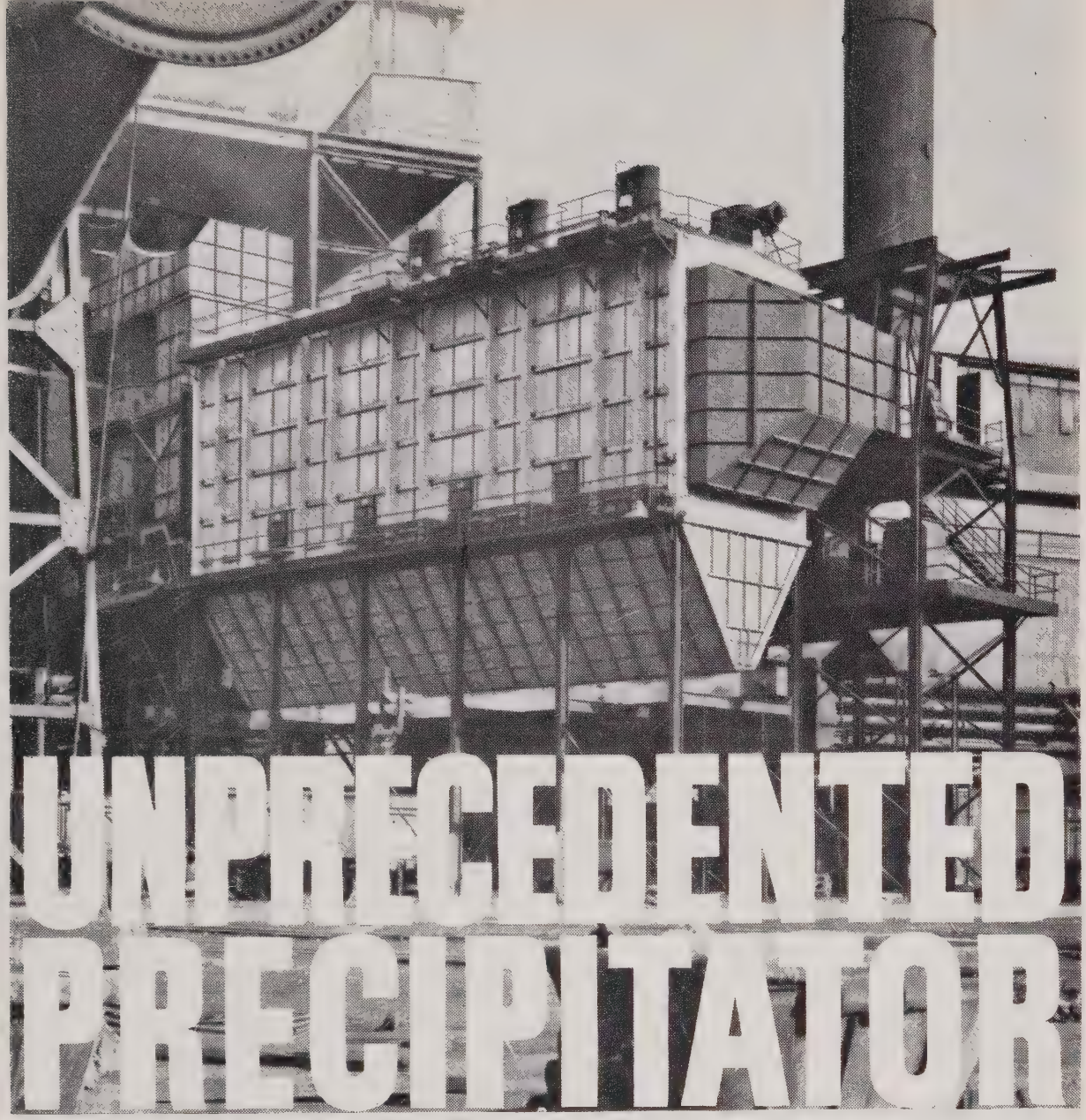

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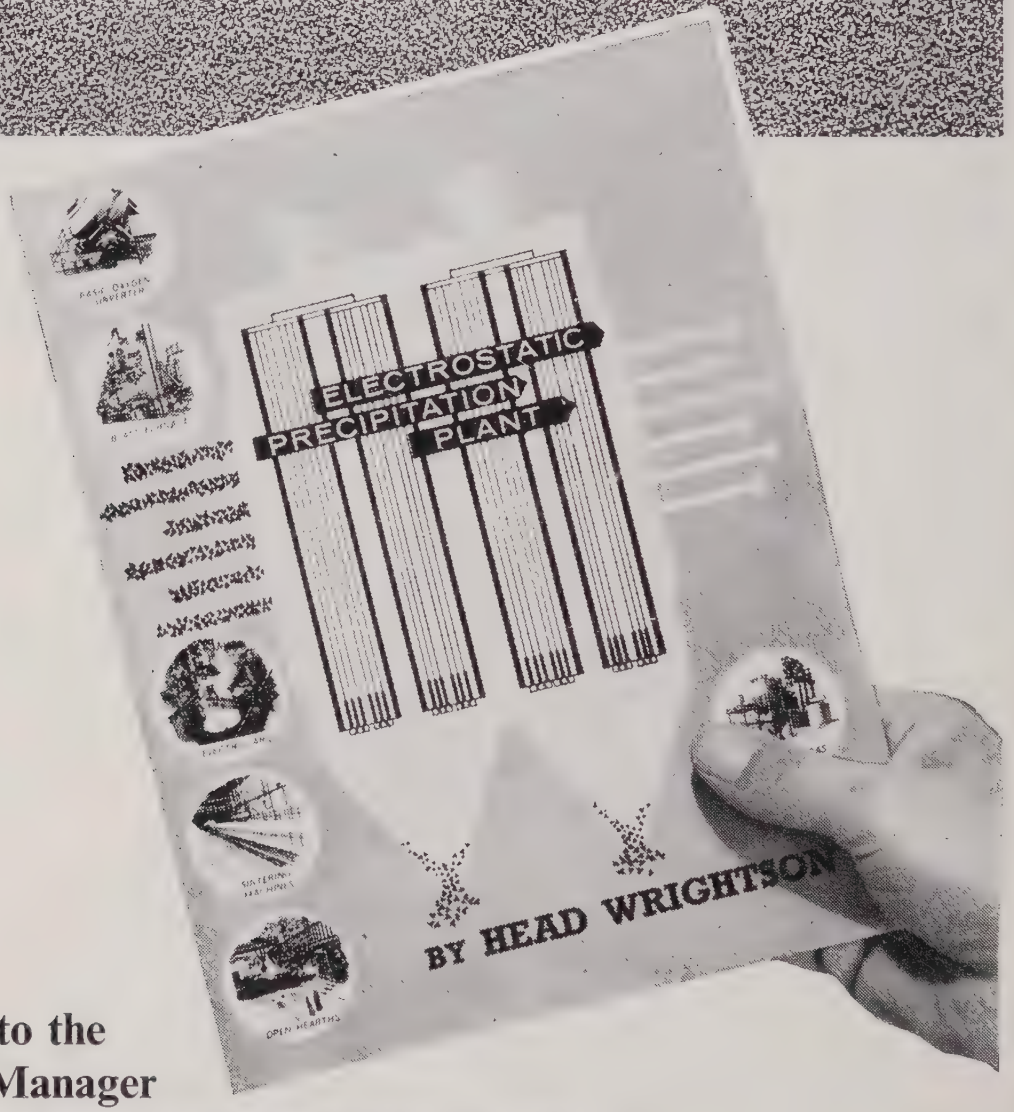
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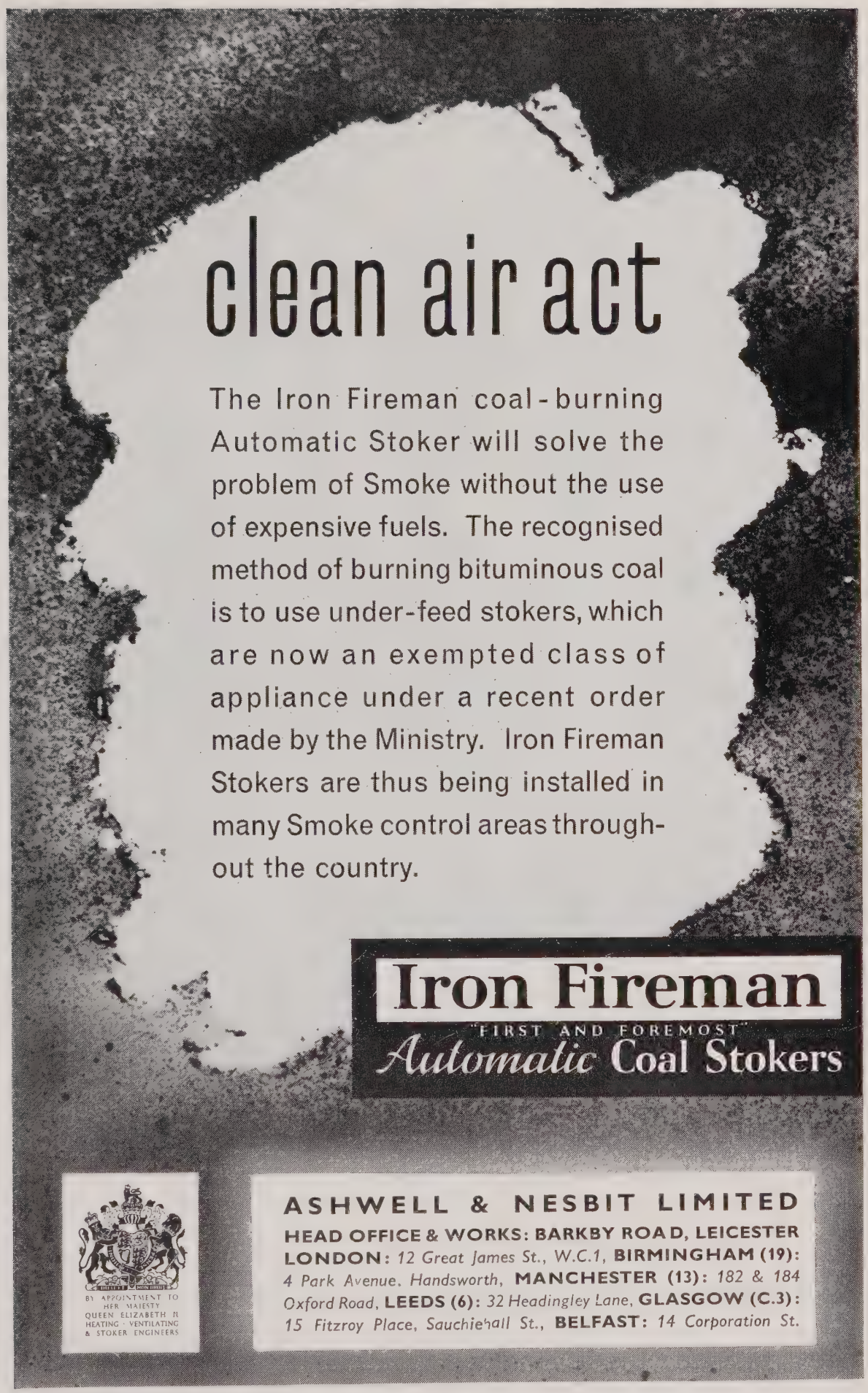


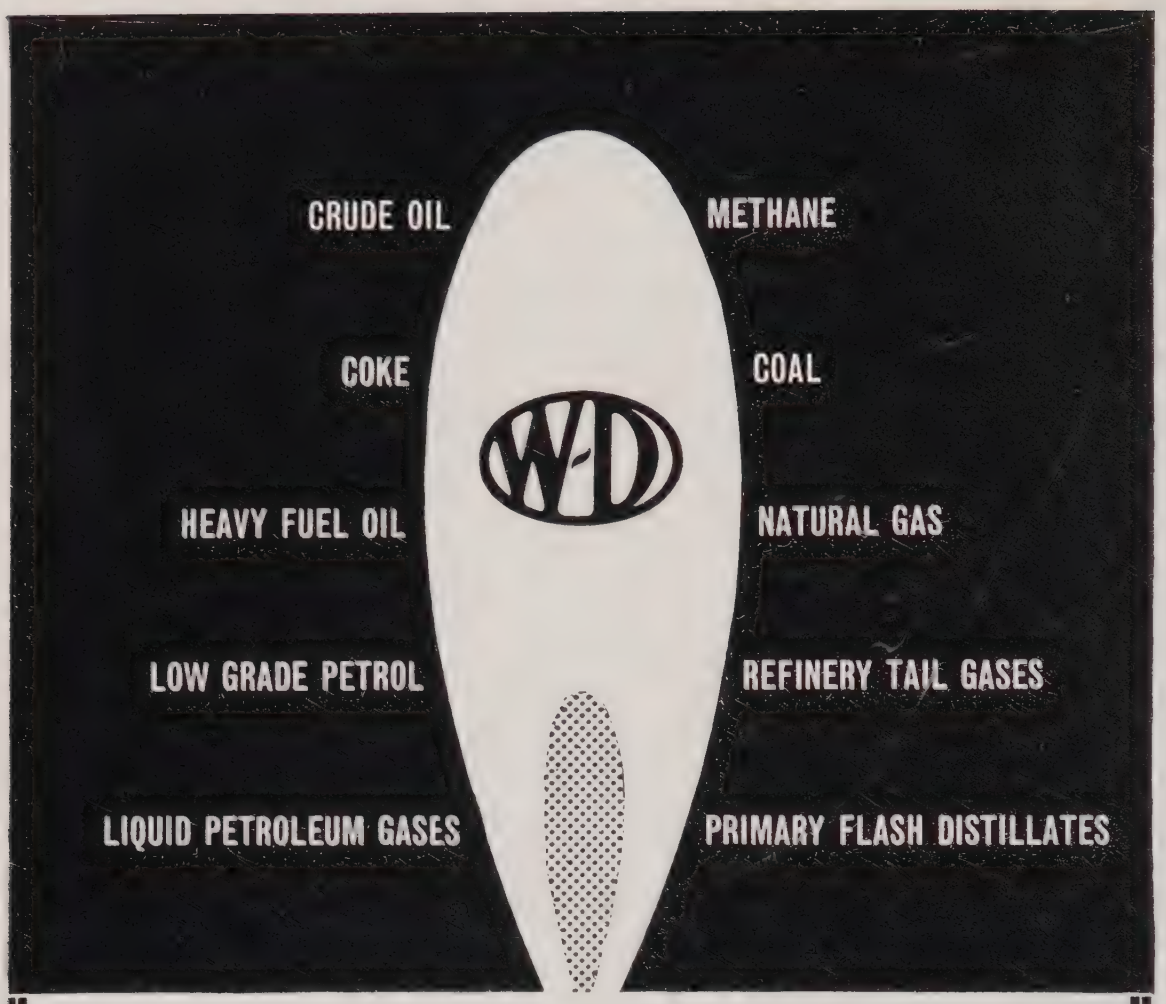

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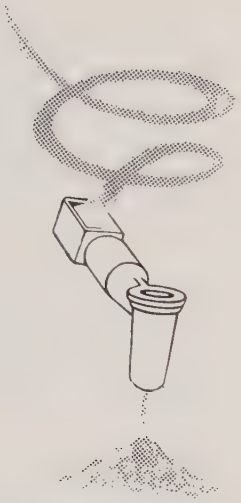
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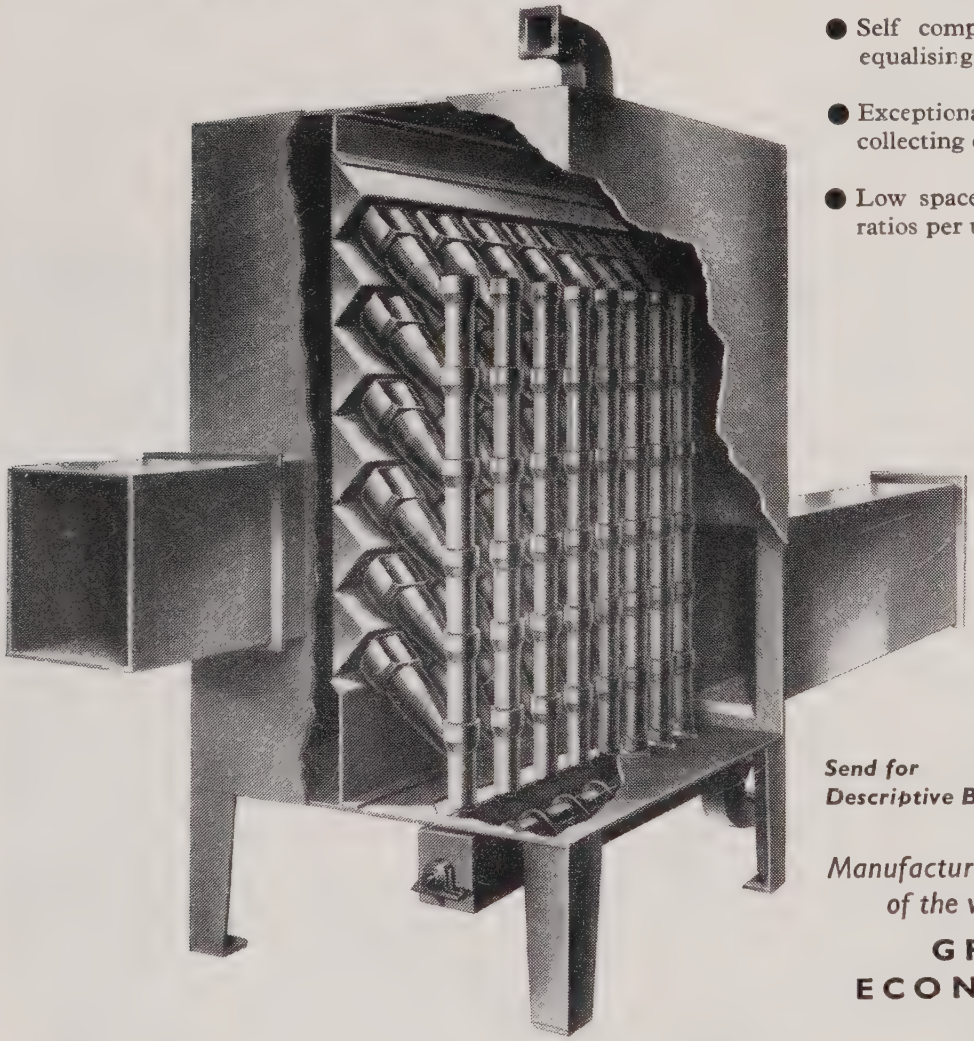
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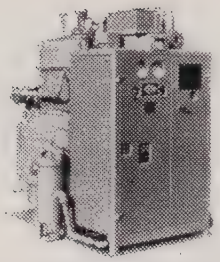
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MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application forms will be sent on request.

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## FORTHCOMING EVENTS

25 April, London

Annual General Meeting, followed by meeting with Address by P. D. Coates on "Problems in Smoke Control Areas". (See page 183).

**October 9 to 12, Harrogate**
**Annual Conference and Exhibition**
(see page 191)

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# SMOKELESS AIR

Vol. XXXII No. 121 Spring 1962


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MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

**Net Certified Circulation 5969**



*Ships, towers, domes, theatres and temples lie*
*Open unto the fields, and to the sky;*
*All bright and glittering in the smokeless air.*

# SMOKELESS AIR

## THE MINISTRY ACTS AGAIN

THE Clean Air Act works. It is beginning to succeed. There is no doubt of this. On the industrial side progress is steady, if unobtrusive, and on the domestic side we shall soon reach the thousandth smoke control area. But this looks better than it is. Many of the smoke control areas are quite small, and the rate of progress, regionally and by individual authorities, is most uneven. To improve the rate of progress—and indeed even to maintain it—calls for much more vigorous action by the less progressive authorities.

The two new Circulars recently issued by the Ministry of Housing and Local Government to local authorities, described on another page, are therefore most welcome. The one, simplifying procedure in setting up smoke control areas, will come as a boon to the authorities who are doing all they can, and will make more difficult the excuses of others. The second, asking for a progress report, will once again make the apathetic do some rethinking and will in due course, when the returns are published, shine some uncomfortable publicity upon them.

The simplification of procedure, in respect to surveys and estimates of conversions, and their costs, is most thorough. To reduce the number of items of information required from 46 to four is a striking and agreeable reversal of what is regarded as the general trend of official requirements. Professor Parkinson should take note.

The full scale, detailed survey of a proposed smoke control area, and the preparation of detailed estimates of costs (so much of which could be out of date by the end of the operation) is now a thing of the past, unless any authority prefers it that way. A sample survey, or other means for giving a reasonable estimate, is all that is required. This will save much time and labour, and we hope it will lead to smoke control areas being introduced more speedily and also to bigger ones. Perhaps more good bites will take the place of cautious nibbles.

The second circular will lead to a new Government memorandum on present and prospective progress. In asking for up-to-date information on programmes it refers to the agreement (which we have previously reported) between the National Coal Board and the Unions on concessionary coal. It is good to see that this awkward problem has at last been solved, and appreciation to those concerned should be recorded. Finally, we were delighted to read the sharp admonition to the more backward authorities with which the circular ends.

### *Coming Event*

The new circulars are not likely to answer all the questions that arise in planning, establishing and operating smoke control areas. We are pleased to announce that at the meeting of the Society to be held on April 25, following the A.G.M. in the morning, there will be an address on " Problems in Smoke Control Areas " by Mr. P. D. Coates of the Ministry of Housing and Local Government. Mr.

Coates, as many of our readers will know, is an Assistant Secretary at the Ministry and is especially concerned with the Clean Air Act. The new circulars have in fact been issued above his name. Questions and answers will follow the address and we foresee a valuable exchange of information.

## *Manchester's Air*

The striking aerial photograph used as a frontispiece is, for the benefit of any who may not have recognized it, the smokeless centre of Manchester. It is rather different from our usual more idyllic scene, but merits reproduction because of its photographic excellence and because of our attachment to this city. Manchester was the home of the Society for many years, the birthplace of this journal, and the first to accept the Society's smokeless zone proposals and to secure the necessary legislation. Manchester may have her troubles with another necessity of life, but as far as her air supply is concerned she can sit back to receive compliments.

## *The Clean Air Council*

Elsewhere we report a recent debate, on a new Alkali Act order, in which, surprisingly, it was asked whether the Clean Air Council was still in existence and functioning as intended. As this was from a Member of Parliament there may well be others who do not know. The Council is most certainly in existence, and we believe that it is functioning well. It certainly hides its light under a bushel, makes no statements to the Press, and in general is heard about only indirectly. It cannot declare any policy, receive any representations, resolutions or deputations. But it can do (and as far as our intelligence service can glean) it is doing, exactly what the Clean Air Act empowers it to do—that is, to advise the Minister and to assist him to keep progress under review. To what extent the actions of the Minister, such as the new circulars we have already welcomed, are due to the Council, or to the Minister and his lieutenants, we do not know, though we may imagine that each encourages the other.

## *Black Market*

The Society's Executive has been asked to look into the problem being experienced in more than one part of the country, where bituminous coal is being deliberately sold for use in smoke control areas, either as coal or under some fancy name to give the impression that it is an authorized smokeless fuel. It is not, as far as the Clean Air Act is concerned, illegal for this to be done, nor is it illegal to burn coal in a smoke control area. The only illegality lies in the emission of smoke. It is nevertheless a flouting of the law and an anti-social act. The matter is being studied and it would be valuable if any readers can give us authenticated instances of it being deliberately done.

Lack of control over the sale of fuel in a smoke control area has always been regarded by some of us as a weakness in the Clean Air Act. What should have been included is some system of licensing sales on the effective lines of the Pittsburgh ordinance.

## *The Widow of York*

All reforms have their opposition, and although that to clean air is remarkably small it does exist, and some of the letters against smoke control areas that appear in local newspapers are genuinely personal, even though the same half-baked arguments turn up time and time again. We were therefore intrigued to find a brand new one in a York paper, over the not so new pseudonym of " Widow." In brief, the writer objected to smoke control areas being set up because it cost money that could be so much better spent in building new hospitals. The good lady ought to have taken the idea

further: if we did not spend so much money on water purification, sewage disposal, road safety, and so on, we would have still more money to spend on still more hospitals.

## *Record of Brighton*

The *Proceedings* of the Brighton Conference, 1961, have now been published at 15s. It is the 27th volume of records of the Society's annual conferences, and we think it is one of the most interesting. There is the Presidential Address by Lord Cohen, Mr. John George's opening address, reports of importance, including one on the National Survey of Air Pollution, four very useful papers on industrial smoke, Mr. Shaw's first-class survey on Whole House Heating Systems, and the papers on smoke control areas and solid smokeless fuels. In addition, and not previously published, are verbatim transcripts of the Transatlantic discussion and of the Questions and Answers session on industrial pollution matters. These records make lively and most interesting reading. The discussions on each session are also included—in all 140 pages of varied and up-to-date information and views on our subject.

## *Dam Funny*

In our last issue, discussing possible new sources of smokeless heat and power, casual mention was made of a proposal for a Channel dam, incorporating a roadway and tidal electricity generators, instead of a bridge or tunnel. We said that although there might be too many snags we hoped that the idea would be carefully studied. The suggestion, which came from France, had been discussed in some detail (two months earlier) by John Maddox, Science Correspondent of the *Guardian*, as part of an article on the various Channel schemes, and it was from this source that our comment was made. It was therefore a surprise to find that the *Daily Sketch* had reported on our remark, in a neat little box, indicating that the Society was actively interested in a Channel dam. This was seen by the B.B.C. and in a news programme on the Light it was stated—we have not the exact words—that the Society was proposing (or even promoting) the project!

If this goes any further we shall find ourselves building the thing.

## CREDIT NOTE

*Following the publication of its Statement on Diesel Smoke (see last issue) representatives of the Society and of the Ministry of Transport met for a most useful and constructive discussion. We are pleased to be able to quote the following question and answer in the House of Commons on February 14.*

**Mr. Ellis Smith** (Stoke-on-Trent, South, Lab.) asked the Minister of Transport if he would make a statement on his policy on the elimination of exhaust fumes from road vehicles.

**Mr. Hay,** Parliamentary Secretary, Ministry of Transport (Henley, C.).—The regulations recently issued on the use of the excess fuel device should have a useful effect in reducing the emission of dark diesel smoke, especially on long hills.

Following discussions with the National Society for Clean Air, we are considering how we can improve observance of the law against harmful fumes. If we succeed in developing a satisfactory method of roadside measurement, it would be possible to impose a specific limit on the density of smoke emitted.

## *Simile for Today*

" . . . it stood out like a volcano in a smokeless zone."—*From a new novel.*

# SMOKE CONTROL AREAS

## *Ministry's New Circulars on Procedure and Programmes*

THE Ministry of Housing and Local Government has issued to local authorities two important circulars on smoke control areas. These are described below, and an editorial comment on them is made on another page.

**Simplified Procedure**

Circular 3/62, headed " Clean Air Act, 1956. Smoke Control Areas ", modifies the procedure laid down in the original " Memorandum on Smoke Control Areas " (1956). Following further review the Minister " has reached the conclusion that the following changes in procedure will make it easier for local authorities to carry through their smoke control programmes quickly ".

The main change is that " he will not in future normally require the estimated and final costs of adapting and replacing fireplaces in privately owned dwellings to be submitted in the detail hitherto required." A greatly simplified form for the estimated costs of adapting and replacing fire-places in private dwellings is given. The extent of simplification is shown by the fact that the original form called for 46 items of information. The new form asks for only four. These are:

1. Number of dwellings erected before July 5, 1956 (estimated if necessary).
2. Number of dwellings erected after July 5, 1956 (estimated if necessary).
3. Estimated number of dwellings in category 1 requiring works of adaptation.
4. Estimated total cost of adaptations eligible for grant.

The schedules of final costs for privately owned dwellings have also been similarly simplified. In both the estimates and the final costs the Minister reserves the right to ask for any further information that seems necessary to him in particular cases.

These changes in procedure apply only to privately owned dwellings, and authorities proposing to carry out works in dwellings owned by them must continue to submit detailed estimates. The relevant table in the original memorandum has been revised and is included in the circular.

The schedules must be accompanied by a certificate that the works were strictly in accordance with the principles laid down in paragraph 26 of the Memorandum. This important paragraph has itself been considerably revised, and the new version is included in the circular. It should clarify many doubts and answer many questions. In the Memorandum the paragraph covers the ground in ten points on one octavo page. In the new version it takes 17 points on two quarto pages.

The conditions of grant have been revised. The principal alteration is that it is now a specific condition of grant that the District Auditor or other authorized officer shall have access to documents and vouchers.

Finally, a most important suggestion—or lead—is given. The circular states:

" Local authorities may wish to consider, in the light of these changes in procedure and of experience gained from establishing earlier smoke control areas, whether sampling or other methods alternative to full-scale survey might now form a reliable basic on which to form an appreciation of the situation and to estimate, for the purposes of Table 1, present and future fuel consumption. They are asked to bear in mind in this connection the great importance of keeping individual householders fully informed and fully advised and of making the

best possible estimates of fuel consumption."

**Smoke Control Programmes**

Circular No. 4/62 is "Clean Air Act, 1956. Smoke Control in the Black Areas". It refers to the previous request to black area authorities on progress in smoke control area programmes, and to the information on this that was published in Command Paper 1113 of 1960. This showed the dates by which local authorities at that time expected to finish the job in their districts and gave their programmes for the five-year period 1959-63.

The circular continues:

"Very nearly three years of the period have gone by. Some of the authorities find that they can now aim at finishing sooner, while the implementation of their programmes has fallen behind.

"The Minister therefore considers that it is time for a general review of the position, in the light of experience gained since 1959. He asks the authorities whose districts are included in the Department's provisional list of black areas to see whether dates originally set for finishing the job can be brought forward, and to prepare programmes for establishing smoke control areas for the five-year period 1962-66.

"In doing so the authorities are asked to take full account of the time likely to be saved by the simplification of the administrative procedures set out in the Department's Circular No. 3/62.

"The authorities are invited to inform the Minister by April 30, 1962, of their conclusions, in the form shown in the Appendix. It is his intention to publish the information in a further Command Paper."

The circular concludes with an important official statement on the special problem of concessionary coal. This paragraph is quoted in full, and in the last sentence the italics are ours —it deserves them:

"A number of the authorities have been deterred from preparing programmes because they have been concerned about the effect of smoke control on persons receiving coal at concessionary rates from the National Coal Board. The National Coal Board and the trade unions have reached agreements whereby the great majority of such persons will in smoke control areas be entitled to receive solid smokeless fuel or cash payments instead of coal, and the Minister trusts that this will remove the obstacle in these cases and that programmes will now be submitted.

*He asks the authorities on the list who for any other reason have not yet prepared programmes to consider again most carefully whether their present policy is consistent with the health and well-being of their communities.*"

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**Smokeless Fire for Health**

In the House of Commons on February 13, 1962, **Mr. Frank Allaun** asked the Minister of Housing and Local Government and Minister for Welsh Affairs if he will introduce legislation to enable grants to be paid to householders for installing special grates to burn smokeless fuels in advance of that area being scheduled as part of a clean air scheme, where a smokeless grate is required on health grounds.

**Mr. Rippon:** No. The interests of people suffering from air pollution are best served by vigorous action to establish smoke control areas. These are a far more effective way of cleaning the air than action by individual householders.

**Stopping the Southward Drift**

Mr. Roy Mason, M.P. for Barnsley, has called for a speeding up of clean air zones, the filling in of derelict canals, a spring clean for grimy buildings, and a face lift for pitstacks. If the West Riding did not take positive steps to do these things the results might be disastrous. One of the serious results of the grime and pollution, said Mr. Mason, is the flood of young people moving south in search of jobs in more agreeable surroundings.

# *Portrait of the Society*

**The National Smoke Abatement Society and the Clean Air Act, 1956, by J. B. Sanderson, Political Studies, Vol. IX, No. 3, October, 1961. Clarendon Press, Oxford, 18s. net.**

*POLITICAL STUDIES* is the journal of the Political Studies Association of the United Kingdom, an organization of which membership is open to persons holding appointments " in political studies or allied subjects in universities and university colleges in the U.K. or colonies." The journal is of a strictly academic character and the other principal articles in the issue containing the article under review are " Politics, Philosophy and Ideology," " Bentham's Conception of Political Change," and " The Commercial and Industrial Interests of the Ministers of the Crown."

The article which has interested us is by J. B. Sanderson of the University of Manchester. It is in effect an intimate case-history of the Society and the part it played in bringing the Clean Air Act into being. The conclusions derived from this careful dissection are not unflattering and it is intriguing to find so detailed an analysis of the Society's motives, methods and achievements.

The article runs to about 7,500 words and 18 pages, with over 70 footnotes. It is based mainly on information from *Smokeless Air*, the Society's annual reports, and hitherto unpublished evidence from the Minutes of meetings of the Council.

The first footnote mentions that in 1958 the Society became the National Society for Clean Air, " but will be referred to throughout by its old name, abbreviated to N.S.A.S." The purpose of the article, it is said, " is to give some account of the pressure-group activity surrounding the Clean Air Act, 1956, with particular reference to the Society as " the only group specifically concerned with this issue."

The author first discusses the history and membership of the Society, though making no reference to the first thirty years, 1899-1929, of its existence. He refers to our diversity of membership, " which, though a source of strength in some respects, can lead to internal dissensions." Instances of these " dissensions " given are our criticism of nutty slack and of the " cosy coal fire " advertising.

The academic quality of the examination is well illustrated by this comment on our membership:

> " In passing, it may be noted that this analysis of the Society's membership suggests that the usual classification of pressure groups into sectional and cause (or " promotional ") groups is not entirely satisfactory. The Society might be thought of as promotional, but this would obscure the sectional element in its composition. A more useful distinction would be one between groups that are the definite and appointed spokesmen for a particular section of the community, and groups that are primarily concerned with the propagation of attitudes (which may well be economically beneficial to certain sections of their support)."

## Policy and Tactics

Then follows a survey of the Society's policy and tactics, based largely on annual reports and editorial comment in this journal—our concentration, because of limited resources, on converting the " informed minority " rather than attempting costly mass opinion campaigns, the need for moderate and factual propaganda, and so on. All of this is true, although it does not seem to have been realized that some of the statements

quoted, both here and elsewhere in the article, may themselves have had a propaganda content. The analysis perhaps does not go deep enough. However, the conclusions reached are acceptable:

> " The Society's authority and knowledge have been the main factors behind what success it has achieved since 1929. They have been the factors which have enabled it, in part at least, to overcome the disadvantages of its inability to stage mass campaigns."

Mr. Sanderson continues by reviewing the media used by the Society in its work, which he lists as publications, the press, lectures and meetings, exhibitions and broadcasting. Curiously, no reference is made to the annual conferences, one of the Society's most important and fruitful activities. On lectures and meetings an unexpected comparison is made: " The Economic League could hold eighteen thousand meetings in 1956, but at this time the N.S.A.S. had only three paid staff who gave lectures."

Next, the " degree of success " is discussed, and mention is made of the smokeless zone principle, originated and advanced by the Society, to the prior approval principle, and to the counter-propaganda by the coal merchants that the Society's success had provoked. The author continues:

> " In general, it can be held that the Society succeeded in establishing a reputation for moderation and knowledgeability in its field. It numbered among its members experts on all aspects of the problem, and was widely looked to for information and assistance. The *Medical Press* summed up its contribution by asserting that while it was ' presumably true that the number of individual objectors to atmospheric pollution by smoke would have been increasing steadily . . . the legislative preparation of the ground could never have been accomplished by individuals. . . . Only an organized body of accepted standing could have produced the favourable climate which was necessary '."

**1952**

The author's narrative then turns to the London fog of 1952 and the events that followed. This is an admirable summary of the situation that developed and led finally to the setting up of the Beaver Committee. The part played by the Society is described and mention is made of matters not previously published. Urging an investigation, the Society " was evidently not convinced that this was sufficient and undertook its own survey, the purpose of which was to present the facts in a readily comprehensible and striking manner before memory of the event had faded."

The growing pressure of public opinion is noted, with the initial reluctance of the Government to take any action, until finally it announced the appointment of a committee under the chairmanship of Sir Hugh Beaver. The membership of the committee, and their interests, are discussed, and the action taken by the Society is stated thus:

> " The N.S.A.S. did not, of course, consider that the presence of its members on the Committee would be sufficient to ensure the friendly report for which it hoped. The Executive Council decided that a memorandum should be prepared containing a comprehensive summary of the Society's views. The result was a document of some ten thousand words which was submitted in January 1954. The memorandum was reprinted in the Society's journal and also published separately, and was reported or reviewed in over eighty newspapers and periodicals. Officers of the Society, its journal records, also had a preliminary informal discussion with the Committee, which was further lobbied when visiting Manchester by members of the Society's North-West Divisional Council.
>
> " A comparison of the Society's memorandum and the Committee's Final Report (published in November 1954) shows how closely, given minor deviations, the Committee followed the views of the N.S.A.S. in reaching its conclusions. The Society's report for 1954, welcoming the Committee's Report, commented that: ' In its analysis of the problem and the judgement made upon it, the report fully, and even vigorously, confirms the case as it has for many years been stated by the Society.' The document

was received by the press with almost unanimous enthusiasm and seems to have been accepted (as the Society urged) as 'the most authoritative statement on the subject that can be expected for a considerable time to come and as the point of focus from which all future discussion and action will develop.'

"Herein, perhaps, lay the fundamental significance of the Committee's work and Report. It was authoritative and provided a basis for future work. Local government, industry, and science had all been represented, and a unanimous report had been produced condemning the evils of air pollution in an outspoken manner and recommending strict legislation to deal with the situation. Given the factors enumerated earlier that made the occasion conducive to the passing of such legislation, there seemed to be a reasonable chance of persuading the Government to act, if it was not already half-persuaded."

On the suggestion that the Government might have been half-persuaded when it set up the Committee a footnote says:

"The evidence regarding the Government's intention in setting up the Committee is confusing, but some of it (the strong membership, the acknowledged vigour of the Chairman, and the wide terms of reference that it could easily exploit) at least points to the conclusion that the Beaver Committee was what K. C. Wheare would probably call a 'committee to camouflage' (see *Government by Committee*, Oxford, 1955, pp. 89-92, for his classification of committees of inquiry), *i.e.* a committee appointed to prepare opinion as a prelude to Government action."

Our own view on this is that the Government was more than half-persuaded that something should be done, but that it needed expert advice on what it was, and authoritative backing if it decided to do it.

**The Nabarro Bill**

The article then examines the Private Member's Bill introduced by Mr. Gerald Nabarro, with support from the Society. This was an interesting and important episode, which, as Mr. Sanderson rightly concludes, was successful in that it accelerated the decisions of the Government in framing and introducing their own Bill. Reference is made to the Society's willingness to assist Mr. Nabarro and to its doubts about some of the provisions he wished to include. After maintaining for some time its "highly equivocal position," it is recorded that Mr. Nabarro:

"attended a meeting of the Society's Executive Council to explain the contents and purpose of his Bill. It seems that he was very persuasive, for at the end of the meeting a unanimous resolution was passed fully supporting the Bill and calling on the Government to adopt it or to substitute its own comprehensive measure."

As will be recalled, the Government did agree to introduce its own Bill during the session if Mr. Nabarro's was withdrawn.

**The Clean Air Act**

The passing of the Clean Air Act is reviewed as an example of pressure-group activity, the two bodies so classified being the Association of Municipal Corporations and the N.S.A.S. Mention is made of "the importance of the committee stage for pressure-group activity, and in the present case such activity was clearly in evidence throughout all thirteen meetings." Although Labour members (Messrs. Blenkinsop and Winterbottom) moved some of the Society's amendments and spoke in support of others, "Mr. Nabarro was, of course, the Society's main representative." In a sense, perhaps, this is true, but it is probably truer to say that the Society was Mr. Nabarro's main adviser. Mr. Nabarro is the representative only of Mr. Nabarro.

**Conclusion**

The final paragraphs of the article may be quoted in full.

"Perhaps three conclusions follow from this survey of the politics of smoke abatement. First, the study shows something of what may be achieved by an economically feeble body in converting an apathetic, or even hostile, public opinion to its views. Thirty years ago visionary faith was required for adherence to the cause. Now smoke

abatement is practical politics. Some reasons for this success have been suggested.

" Secondly, Mr. Nabarro's relationship to the Society deserves additional comment in so far as it fails to confirm the impression that may be gathered from the relevant literature of groups eagerly co-operating with M.P.s acting on their behalf in the House, particularly with respect to the introduction of suitable Private Members' Bills. The usual picture is one of groups pressing in from the periphery towards the centres of political activity in order to achieve their ends, but in this case the M.P. was the iniator and the group was at first reluctant to assist his efforts.

" Finally, the conclusion may emerge from the narrative of events after the London fog of December 1952 that securing the establishment of a committee of inquiry of some kind at a crucial juncture is a fundamental part of attitude group tactics. Such groups are consulted much less frequently by Governments contemplating legislation than are sectional-spokesmen groups; and the setting up of a committee of inquiry at the right time can well be the most important factor in the achievement of their aims. When the Beaver Committee was first established, the N.S.A.S. commented that ' the Committee can hardly fail to produce a report that will be welcomed by the Society '. The converse of this proposition would be that there will often be occasions when groups will not welcome committees of inquiry; at the moment the position of the R.S.P.C.A. with regard to vivisection and that of the Lord's Day Observance Society with regard to the state of the Sunday observance laws would appear to provide evidence for this assertion."

Considered objectively, the survey is an interesting, clear, and convincing inquiry into and analysis of the purposes and activities of a voluntary organization, expressed in terms of a specific academic discipline. For those in that organization, intimately concerned with the events described the necessary objectivity is not easy to attain: it is rather like seeing oneself in a film. The image presented, as built up by a stranger, may on the whole be gratifying, but one is aware of a certain inevitable over-simplification and an absence of the background detail that is never recorded in print (or in minutes). Perhaps this does not matter very much, but nevertheless there are vital factors that cannot be seen—or felt—from the outside.—*A.M.*

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# *The Forthcoming Conference*

The Society's 1962 conference at Harrogate in October will have an exceptionally interesting programme. It has been decided not to repeat last year's experiment of a Friday afternoon session, but to finish at lunchtime on that day. However, to provide the time for technical papers for those who desire them, without encroaching on the limited conference time, there will be a special " Pre-Conference " technical session during the late afternoon of Tuesday, October 9. Other bodies are being invited to be associated with this and their Yorkshire members will be invited to attend. Although in a sense separate from the conference this meeting will of course be open to all delegates, and it is hoped that many will attend—even if it may mean catching an earlier train. The subject for this first special meeting will be air pollution problems in the iron and steel industry, including coke-ovens.

## *Earl Jellicoe*

The Conference itself will begin on the morning of Wednesday, October 10, and we are pleased to be able to announce that it will be opened by Earl Jellicoe, Joint Parliamentary Secretary of the Ministry of Housing

and Local Government. After his address Lord Cohen of Birkenhead will deliver his second Presidential Address.

Another important session will be devoted to one paper only: a progress review of the work of the Alkali &c. Works Inspectorate since the passing of the Clean Air Act, to be given by the Chief Inspector, Dr. J. S. Carter. Dr. Carter has not wished to do this before now: rightly preferring to wait until real and positive progress could be reported.

A different " progress " session will be international—three or four papers by representatives of European countries, and, we hope, U.S.A. They are being invited to tell us of new developments and progress in their several countries. With the U.K. moving closer to Europe contact and co-operation between national clean air movements is of growing importance and can be of mutual benefit.

A pollution problem causing increasing concern is that arising from the incineration, or use as fuel, of waste materials, and this is to be the subject of the final session on Friday morning, with an introductory paper by Mr. S. Cayton. The overriding question of smoke control areas and domestic smoke is naturally not overlooked, and on this occasion its discussion will take the form of a " questions and answers " afternoon, with a panel of experts on the platform.

The Society's Exhibition, in conjunction with the Conference, is already assured of being a bigger and more comprehensive show than any of its predecessors. Please note the dates: Conference October 10 to 12; special Pre-Conference Session, on Thursday afternoon, October 9. There will be the usual informal " get together " on the evening of the same day.



*Members of the North-West Division in the new Manchester Law Courts, where they inspected the electrical heating system*

# A NEW ALKALI, &c., WORKS ORDER

## *Discussion in the Commons*

A NEW Alkali &c. Works Order, 1961, (S.I., 1961, No. 2261), made November 23, 1961, came into operation on January 1, 1962. It includes in the existing list of noxious or offensive gases fumes containing uranium, beryllium, selenium, sodium, potassium or their compounds, and carbon monoxide. It also includes in the list of scheduled works treating or preparing material containing uranium, beryllium and selenium. Excepted are uranium works already controlled as nuclear installations, etc. There is also the definition of Caustic Soda Works, so that it includes works in which black liquor produced in the manufacture of paper is calcined in the recovery of caustic soda.

The Order was discussed in the House of Commons on January 29, 1962, by the curious procedure of moving its annulment in order that it might be welcomed. The motion was put by **Dr. Barnett Stross** (Stoke-on-Trent) who firstly wished to obtain more details and to put some questions, and secondly wish to draw attention to the work done by the Alkali Inspectorate, " and the watchful care they have over new and dangerous processess ". He wished to be assured that the Inspectorate would be increased in number, and not allowed ever to fall, and:

> " that acceptance will be given to the fact that they have to have very rare qualifications and that they are, therefore, difficult to recruit, and that, therefore, their salary scales and conditions of work will be such that we shall always get at least the protection we have had up to now."

Dr. Stross's questions were on the caustic soda works addition, and on the implications of including uranium, beryllium and selenium.

**Mr. Gerald Nabarro** (Kidderminster) spoke next, and asked a number of questions about " the strength and efficacy of the Alkali Inspectorate and its competence numerically and otherwise to deal with the very substantial number of additional establishments which will fall within its ambit of responsibility if this Order is passed by the House."

He was also curious about the listing of carbon monoxide, pointing out that its emission " from static works is relatively tiny compared with the huge volume of carbon monoxide put into the atmosphere through the exhausts of vehicles."*

**Mr. R. E. Winterbottom** (Sheffield, Brightside) wished to know whether the Clean Air Council was still in being, and whether or not " it has functioned in its purposes as provided for in the Act and made recommendations to the Minister." He was particularly concerned about how Sheffield stood as a result of the new Order, reminding the House that in that city many of the responsibilities of the Alkali Inspectorate had been restored to the municipality. Since this special dispensation had been given to Sheffield, he said, the arrangements between the Sheffield authorities and the Inspectorate had been first-class.

**Mr. G. R. Mitchison** (Kettering) pointed out from the Estimates that for the coming year the Alkali Inspectorate would consist of a chief and two deputy chiefs, twelve district and ten other inspectors—although at the moment there were only seven inspectors. He was doubtful whether

* Mr. Nabarro referred later to the high volumes of carbon monoxide from the exhausts of diesel vehicles. There is in fact little or none of this gas in diesel exhausts; it is the dangerous constituent of petrol engine exhausts.—Ed.

there should be two sets of inspectors for uranium works. He contrasted the perils from radiation pollution and from ordinary air pollution. He felt that the new Order would be justifiable, even if it was somewhat unintelligible in its language " and even more unintelligible when one tries to find out what it is about."

**The Reply**

The Joint Parliamentary Secretary to the Ministry of Housing and Local Government **(Mr. Geoffrey Rippon)** replied. He assured Mr. Winterbottom that the Clean Air Council still functioned and was very active.

Mr. Rippon introduced two delightful quotations into his speech. We had, he said, come a very long way since the first Chief Alkali Inspector began his report in 1872 with the words:

> " In former years when I reported on the escape of muriatic acid from alkali works, being rather weary of the monotony as well as the narrowness of the subject, I commenced inquiries into other gases."

And the medical officer of the Local Government Board in 1878, talking about Stoke-on-Trent vomiting black smoke from chimneys, said:

> " Certainly it is not conducive to mental exhilaration and, inasmuch as it fouls the skin and clothing and sometimes compels householders to close the windows of their houses to keep it out, must be on these accounts alone unfavourable to public health, especially among children and classes of persons not much given to ablution."

" We have come some way in Stoke-on-Trent since those days," continued Mr. Rippon.

**Dr. Stross:** " I am grateful to the hon. Gentleman for pointing out how much has been done in Stoke-on-Trent. Is he aware that the atmosphere has been so much improved there that I think it is a little better than that of Kensington? "

Continuing, **Mr. Rippon** agreed with what had been said about the toxic nature of the gases concerned. Beryllium was 250 times as toxic as arsenic, selenium five times as toxic and uranium twice as toxic.

The Nuclear Installations (Licensing and Insurance) Act, 1959, covered uranium works, other nuclear reactors and operations involving fission products where any hazards are essentially of a radioactive nature. The requirements under the Alkali Act were related to processes where the hazards were fundamentally of a toxic nature.

On carbon monoxide and sodium and potassium fumes the Minister said: " What happened was this. The 1958 Order brought under the Alkali Act a large number of new processes because they emitted smoke, grit and dust. As a result of the expertise our Inspectorate going round and doing their job, it has been found that besides emitting smoke, grit and dust some of these processes emit gases which are noxious or offensive but are not formally so listed in the Act. The mischief against which the Order is directed is the emission of carbon monoxide which is evolved during certain iron and carbonization processes, sodium and potassium compounds evolved during the salt glazing of earthenware—so far as I know no alternative process can be employed in regard to salt glazing—and sodium compounds evolved in certain aluminium processes. Here again, and with the ready co-operation of the industry, the Inspectorate has been taking steps to ensure that the emission of these gases is properly controlled. Here again, the Order is merely putting into formal Statutory form what is already being done."

## *QUESTION*

## *AND SHORT ANSWER*

**Mrs. Hill** asked the Chancellor of the Exchequer if he will abolish Purchase Tax on all appliances needed to comply with the Clean Air Act, when an order under this Act is imposed on a district.

**Mr. Barber:** No.

# *INTERNATIONAL SECTION*

*Europe*

## COUNCIL OF EUROPE : AIR POLLUTION PROPOSAL

The Social Commission of the Council of Europe, presided over by M. Radius, Deputy Recorder and Joint Mayor of Strasbourg, has drawn up a recommendation relating to air pollution. This was adopted by the Consultative Assembly of the Council on September 23 last. It advocates the formation of a special Commission charged to prepare the programme of a European Conference to be held in Strasbourg. Such a conference, gathering European personalities expert in the fields of science, technology, medicine, industry, law, economics and journalism, with representatives of the World Health Organization and of the Public Health Service, Washington, would aim at facing the problems of the countries represented in the Council and promoting collaboration between these countries in the fields of information, documentation, research, terminology and, eventually, legislation.

### RIVIERA CONFERENCE

On February 13 to 15, 1962, the European Association of Social Medicine organized, with the co-operation of member societies and the French Association pour la Prévention de la Pollution Atmosphérique, a conference on the subject of air pollution and its prevention. Taking place, rather unusually, in both San Remo, Italy, and Nice, France, the conference consisted of three study sessions as well as various social functions. We hope to be able to include in our next issue a fuller report from one of the British delegates.

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*Germany*

## TAX CONCESSIONS CONTINUED

***from Dr. O. Schmidt,***

*Member, Federal German Parliament and President, Inter-Parliamentary Working Community, Bonn*

Upon the initiative of members of the Inter-Parliamentary Working Community in the Federal Parliament, the law to amend the provisions of the Fiscal Law of July 26, 1957 (see *Smokeless Air*, Summer, 1958, No. 106, p. 263) also provided special facilities for writing off assets in regard to installations which directly and exclusively serve the purpose of preventing, abolishing or reducing air pollution. Up to the end of 1960 these facilities were limited. In view of the new legislation in 1960 for the prevention of air pollution, however, the federal legislation has extended the facilities until the end of 1965.

The 1961 law amending the taxation laws (July 13, 1961), included a further amendment necessitated by practical difficulties. This consisted of the insertion of Article 51 in the relevant prescription, by which special assets may be written off, should, pursuant to official orders, factory chimneys have to be built or heightened in order to prevent air pollution.

### M.A.C. FOR SULPHUR DIOXIDE

***from Dr. Helmut Kettner***

The Commission for Air Purification has adopted another maximum

allowable ground limit concentration for sulphur dioxide. The values are: for long term 0·2 ppm., and for short term 0·3 ppm. The long term concentration can be exceeded by the short term up to 30 minutes within any two hours (see also *Smokeless Air*, Autumn, 1961, No. 119, pp. 34-5). Reference: V.D.I. 2108, November, 1961.

Dr. Kettner also contributes a paper on $SO_2$ M.A.C.s in " Staub " (21, 1961, No. 12, December 15) of which the following is a summary:

Taking the example of the maximum permissible $SO_2$ concentration in atmospheric air it has been possible to show that the values can vary depending on the basis of standardization. Very strict requirements are laid down in the Soviet Union where only such concentrations are permissible as produce no indicatable change in the organism. Whilst in the German Federal Republic and the Soviet Union two relatively low concentrations have been derived, one for short term and the other for long term concentration, higher concentrations are permitted in the U.S.A., but these are limited by correspondingly shorter times. The American standard also provides for special daily concentrations.

*Italy*

## POLLUTION BY FLUORIDES

We have received from the Institute of Sanitary Engineering, Milan, four papers on a study of atmospheric pollution by fluorides, carried out by the Institute. The papers comprise a critical review of the technical world literature on the subject, methods for the determination of fluorides in air and water, and two cases of fluoride pollution which occured in Milan. One of these was an interesting case of fluoride injury on vegetation from an enamel factory.

*France*

## PARIS POLLUTION SURVEY

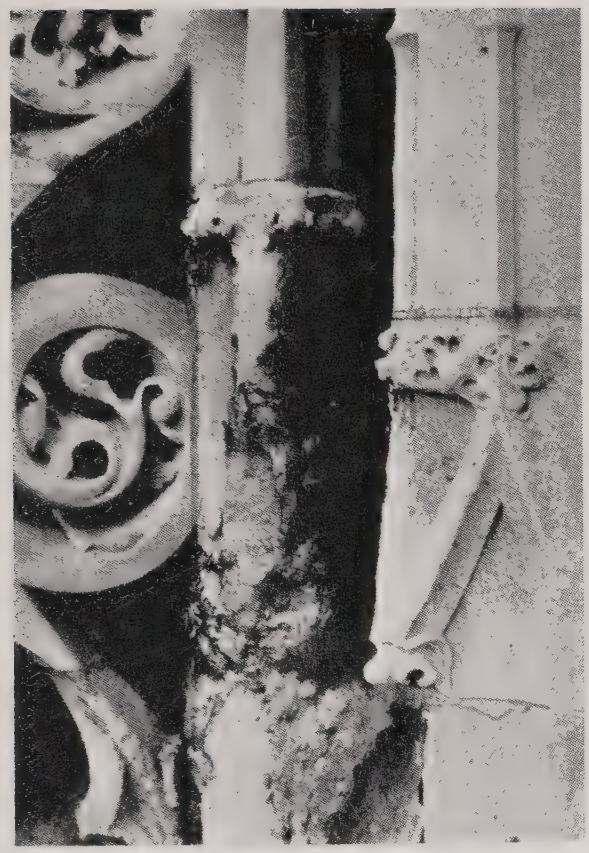
We have received the 1960 report of the air pollution survey of the Préfecture of the Seine, Paris. Systematic measurements undertaken by the Laboratory of Hygiène in 1954, and expanded in 1956 to a total of ten stations, have been continued in 1960, with two new stations added to the network towards the end of that year. Continuous recordings of instant variations of the carbon dioxide, carbon monoxide and smoke content of the atmosphere have been continued at the central station. In addition, since December, 1960, there has been a systematic evaluation of sulphur dioxide.

The filtration of air through " teflon " wool, and the weight of smoke thus obtained monthly, has been continued and the method improved. The proportion of tarry matter present in micron sized particles suspended in the air has been established.

The apparatuses used for the carbon dioxide and carbon monoxide determinations are analysers of the Onera 80 type, which are based on the principle of absorption in infra-red



*Taking air samples on the Tour Saint-Jacques*



*Erosion of Pilasters on the Tour Saint-Jacques*

light. Measurement of smoke is effected by filtration through CA32 paper and the reflectrometric measurement of the stains thus obtained.

The results obtained are tabulated in various appended tables and graphs. The accompanying photographs showing stonework deterioration in Paris are taken from the report.

*U.S.A.*

## TEN MILLION DOLLARS FOR A.P. RESEARCH

***from Arthur C. Stern,***
*U.S. Public Health Service*

In President Kennedy's budget request to Congress, he included an appropriation request for air pollution research and technical assistance for $10,069,000 for the fiscal year starting July 1, 1962. This represents an increase of $1,269,000 over the appropriation for the current fiscal year. The request has still to be acted upon by Congress.

This year is the second one that the National Advisory Committee on Air Pollution is working on a rotating membership basis. Six members retire and new appointments are: Arthur J. Benline (Dept. Air Pollution Control, New York City), Curtiss M. Everts (Oregon State Sanitary Authority), Dr. Herman E. Hilleboe (Commissioner of Health, New York State), Dr. Thomas F. Malone (Research Director, Travellers Insurance Co.), Dr. Jerry McAfee (Gulf Oil Corporation), Victor G. Raviolo (Ford Motor Co.).

*Regional Developments*—The legislatures of both the states of New York and New Jersey have approved legislation authorizing the Insterstate Sanitation Commission (New York-New Jersey-Connecticut) to maintain an interstate activity in air pollution control, and each has appropriated funds to the Commission for this purpose.

The New York State Air Pollution Control Board has recently adopted state-wide rules for the prevention of air pollution from new sources. These rules become effective on April 2.

The State of New Jersey, in cooperation with the New Jersey State Chamber of Commerce, is initiating a State Air Sampling Network. The report of the state-wide air pollution survey of the State of Pennsylvania conducted jointly by the State Department of Health and the United States Public Health Service, has been published with the title " Pure Air for Pennsylvania."

A voluntary oxidant sampling network has been initiated by a group of governmental agencies in the Washington, D.C., metropolitan area.

Mr. Stern in his letter encloses programmes, or gives particulars, of national meetings and conferences of air pollution interest recently held, or to be held, in the U.S.A. One of these is an international meeting, the 8th Congress of AIDIS (Inter-American Association of Sanitary Engineering), to be held in Washington, June 10 to 15, 1962. It may be possible to report

more on these meetings in future issues.

*Southern Rhodesia*

### A. P. LAW DRAFTED

Legislation to control South Rhodesia's increasing smoke menace is now under draft form, reports the *Rhodesia Herald*. Salisbury is particularly affected, especially at night in the winter, with low-lying smoke from domestic fires and around railway shunting yards and engine sheds.

*New Zealand*

### A.P. POLICY PROPOSALS

The N.Z. Health Department has approved a national policy for air pollution control formulated by its Air Pollution Committee. Proposed smoke density regulations have been assembled and passed for attention to legal form, with a recommendation that industry should have a further opportunity to examine the draft. Methods of air pollution sampling suitable for New Zealand are being reviewed.

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*Sweden*

## A VERTICAL STEAM GENERATOR

*from*

*Carl-Eric Holmquist*

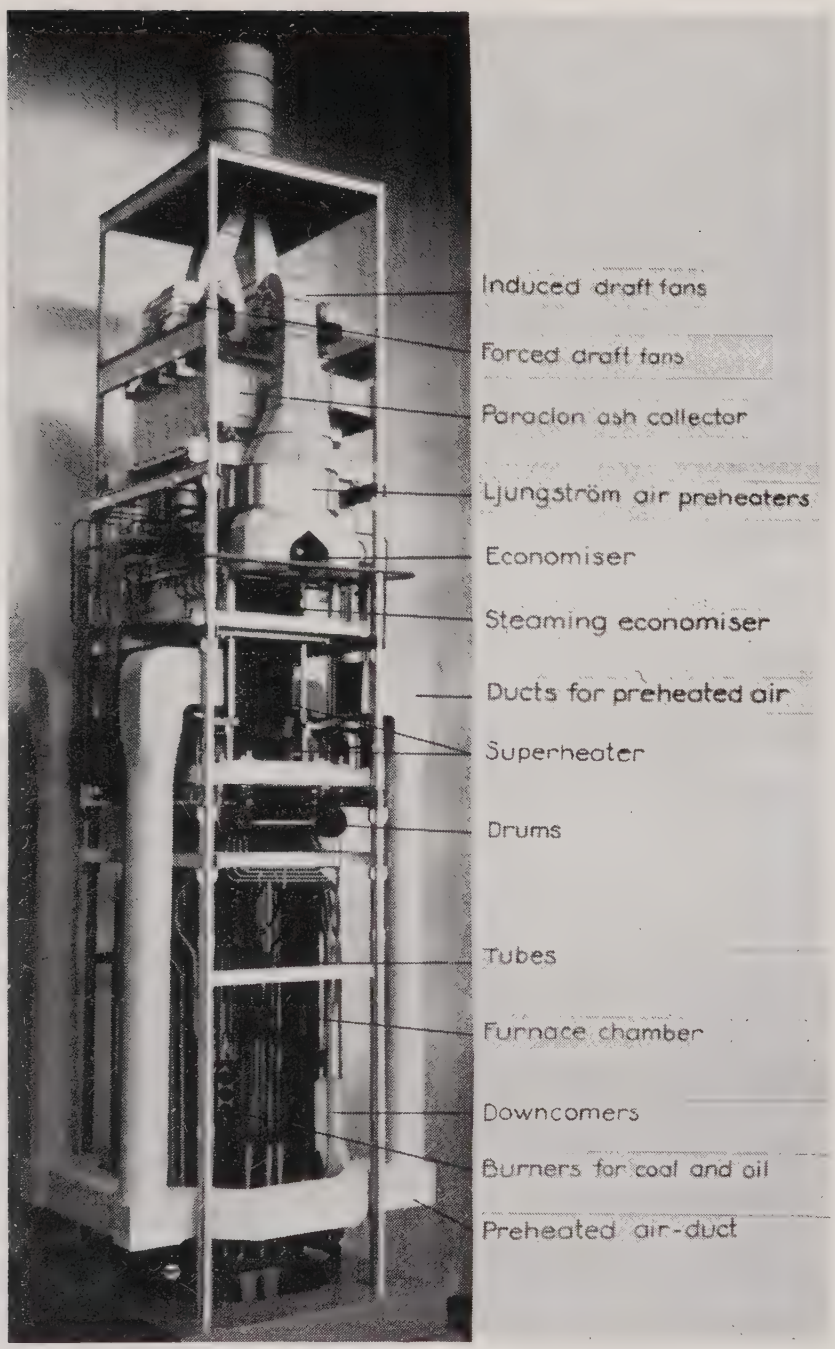
*(Reference was made by a speaker at the N.S.C.A. Brighton Conference, during a discussion on chimney heights, to a "vertical" power station in Sweden. We followed this up, with the co-operation of Dr. Bertil Wedin, and have been pleased to receive the following article and illustrations.—Ed.)*

THE technique of steam power production in Sweden is quite advanced in spite of the fact that Sweden's water power resources still are the dominant domestic source of power supply. However, conventional heat power (steam power and gas turbines) has for some time played an important rôle to compensate for time fluctuations of the available water power.

The steam power station in the town of Västerås, some 80 miles west of Stockholm, belonging to the grid of the Swedish State Power Board, is one of the largest of its kind in Sweden. The station was completed by 1952



*The Power Station at Västerås, Sweden*




*Model showing the vertical arrangement of the steam generator*

when two steam generators, P13 and P14, of 300 tons of steam/hr. capacity each were added thus bringing the total steam production up to 1,200 tons of steam/hr.

The rather unique design of the boilers, as seen in the illustrations, requires some explanation. The main purpose of the station is to be a supplement to water power and to take care of the peak power production during periods of low water tables in the magazines. This means that the boilers must be able to reach their full power in a very short time, around 25-30 minutes, without any hazard of explosions from remaining gas mixtures in the furnace chambers. This lead to a straight, vertical design, so called tower boilers, which also diminished the need for fan power. Besides this the available building-lot was very limited and did not permit building of a conventional low boiler-house. As picture nr 2 indicates, the furnace chamber, superheater, economizers, preheaters, dust-collector unit, fans and chimneys all are built into

one vertical column with no chance of explosive gas mixtures remaining in pockets. With this type of compact and tall construction the necessary chimneys could be made rather low and would not dominate the structures. The smoke plume is less subjected to downwash due to the effect of adjacent buildings. The power station is located in the middle of the industrial part of the town.

There have been no complaints about air pollution from the neighbours. The boilers can be either coal or oil fired. Flyash and dust is collected in a high efficient multicyclone dust collector of Swedish design (AB Svenska Fläktfabriken). When exclusively oil fired the station consumes about 50 tons of oil/hr., which creates an emission of about 75 tons of $SO_2$/day at peak load. The point of discharge is 200 ft. above ground, which in fact is rather inadequate in comparison with the new recommendations proposed in England and Germany. However the chimney-discharge velocity is high (around 60 ft./sec.) and to this comes the large volume of discharged air (typical for power station) which all tends greatly to increase the effective chimney height. (A more detailed description is given, in Swedish, in Teknisk Tidskrift, 1952, no 7).

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*Japan*

## TOKYO DRIVE SUCCEEDS

Two years ago, the Tokyo Metropolitan Government undertook a concentrated drive to clean up the air. Certain " model districts " were marked out and every effort was pursued within them to lighten the smoke emissions. Last year more districts were added. Previously, 59 per cent. of the boilers and furnaces subjected to the survey had been violating the municipal ordinance on smoke. In the first year this was reduced to 29 per cent. and last year to 7·8 per cent.

*Lebanon*

## BAN ON DIESELS

A law has been promulgated under which during the next thirty months all diesel-driven vehicles in the Lebanon must be replaced by petrol vehicles. The number of vehicles involved is about 3,600 taxis, buses and lorries, plying mainly between Beirut and the mountains. Grants towards the cost of the change will be made, and petrol engines are to be imported free of customs duty. The *Iraq Times* reports that the primary reason given for the ban is that the incidence of lung cancer has risen proportionately to the increase in the number of diesel-driven vehicles in use, but it is also pointed out that the use of diesel oil instead of petrol is losing the Treasury about £595,000 a year in excise duties.

*Jamaica*

## CLEAN AIR BILL

A Bill designed to make provisions for abating the pollution of the air has been passed by the Legislative Council of Jamaica, reports the *Daily Gleaner*, Jamaica. The Bill appears to schedule industrial processes to be subject to control, and for the administration to be by Technical Inspectors of the Government.

*India*

## Zoo Report

" The struggle for existence becomes more intense every day. An African lion has just died in the Madras Zoo from the effects of smoke from the engines at the railway station nearby. A sea-lion has also died. Now the zoo is to move."—*Report from a Northern Rhodesia paper.*

*U.S.A.*

# AUTOMOBILE POLLUTION IN CALIFORNIA

*By F. Emerson Ivery, Jr.*

*We are pleased to print this address read to the New York Society of Security Analysts in October last, because it will be, to U.K. readers, a clear and authoritative review of the petrol vehicle pollution control situation in California, about which information here is frequently scanty and not always accurate.*

THE State of California is the only area in which systematic scientific studies have defined the extent to which the automobile contributes to air pollution and smog formation. It, therefore, becomes reasonable to use the performance standards required of automobile exhaust control devices in California as universal criteria. These standards state that a device must reduce the hydrocarbon content of the exhaust gas to less than 275 ppm (0·0275 per cent. by volume) and the carbon monoxide content to less than 1·5 per cent. by volume. It is also required that a device remains within these standards during its entire life, which shall not be less than 12,000 miles, or approximately one year of use.

The technology for burning hydrocarbons and carbon monoxide into carbon dioxide and water with practically 100 per cent. efficiency is neither new nor particularly difficult. There are two basic approaches: either combustion by direct flame, or flameless low-temperature combustion on active catalytic surfaces. Both technologies are applicable to the control of automobile exhaust gases. One may then logically ask why the practical solution is not already in hand. There are three reasons: (1) the incompatibility of an automobile with an exhaust control device, (2) the high standards of performance required by law, and (3) the uncertainties upon which some of these standards are based. Let's consider these in order.

Any exhaust gas control device is fundamentally a chemical reactor, whether it be a direct-flame afterburner or a catalytic muffler. In designing such a high efficiency reactor, any knowledgeable engineer would make certain that its essential operating variables were established and controlled at proper levels. These would be the rate and the composition of the gases fed to the reactor, the temperature at which it would operate, and its size and shape.

However, when this same engineer attempts to adapt his reactor to automobile exhausts, he finds that not a single one of these fundamental operating variables is within his control. The rate of exhaust gas flow varies indiscriminately from as little as one or two cubic feet per minute to over 60 cubic feet per minute, depending on the size of the engine and the speed at which it is voluntarily driven. The hydrocarbon and carbon monoxide contents of the exhaust gases fed to the reactor can range from as low as 200 ppm and 2 per cent to over 4,000 ppm and 12 per cent., depending on the type of engine, its mechanical condition, and the driving habits of the operator.

In attempting to control operating temperature, the engineer is truly on the horns of dilemma. Both direct flame afterburners and catalytic mufflers require heat to operate, and this heat comes from the combustion of the compounds he is seeking to destroy. But as already mentioned, the quantities of these compounds vary extravagantly, hence so does the amount of heat released. At times, there is more heat available than is required, and the device will over-heat, potentially to destructive tempera-

tures. At other times, notably at start-up with a cold engine, there is insufficient heat available to initiate the combustion reactions in a practical time interval. If the reactor is insulated to conserve heat and thus assist its cold-start performance, it will overheat under some driving conditions; if it is left uninsulated to protect its road performance, then its cold-start characteristics suffer.

The ultimate offence to the engineer occurs when he finds that few automobiles have proper space available for his reactor. He can't use the trunk compartment because of the tremendous heat liberation. He must stay away from the gasoline tank for the same reason. The engine compartment is already jammed with power brakes, power steering, air conditioners, and incidentally an engine. Under the car is a space which seldom exceeds five inches height if one is to maintain the barest road clearance.

This, then, is a bare description of the problem engineers face in attempting to fit either a direct-flame afterburner or a catalytic muffler to an automobile exhaust system. The two types of device are affected to different degrees by each of these problems, and, therefore, the approaches to the solutions must also differ.

Now consider the effect that the high standards of performance and acceptability, as established by the California MVPCB, have upon the speed of solution of these problems. These standards fall into two categories: objective evaluation of technical performance during use, and qualitative judgments concerning safety and reliability.

Until May of this year, there was no recognized way of determining when an exhaust device would be in compliance with the previously mentioned emission standard. Did this standard mean that a device had to operate within the limits on every car during every possible type of driving? Or did it mean that a device would be acceptable if it held the emissions from every car within these limits during every trip? If so, then what would constitute a trip? Or perhaps each car was not to be considered as an individual, but rather the limits were to be applied to groups of cars according to some classification of engine size, type or manufacture. And, in any event, how were the emissions to be measured? Real progress in device design was impossible until answers to these and many other questions were known.

Prior to May, technical experts from the automobile manufacturing and supply industries had been working diligently with the Staff of the California Motor Vehicle Pollution Control Board and the California Department of Public Health to find technically sound bases for defining acceptable device performance. During this period, many companies working on device development came to their own conclusions on how to measure and judge performance, and proceeded to steer their research programmes in the directions thus indicated. As a result there appeared, around the turn of the year, enthusiastic reports of devices which were capable of eliminating the automobile smog problem. These claims were short-lived, for when the Board announced its official test criteria for compliance in May, manufacturers soon discovered that their devices were unable to meet the severe requirements thus specified.

**The Test Programme**

Briefly, the California performance test programme (called "Step 1 Testing") involves mounting of devices on a fleet of 25 typical cars, accumulating mileage by routine-type driving, and periodic laboratory measurements on each car to establish the level of performance of the group of devices with mileage. The laboratory test is highly standardized, involving a specific chassis dynamometer and specific instruments for measuring exhaust emissions. When on the chassis dynamometer, the car is driven from a cold start through a sequence of driving modes which includes all those found in normal driving and in

approximately the same proportion. Emissions of hydrocarbons and carbon monoxide during the entire 20 minute test are continuously recorded, and later these data are recalculated on the basis of the differences in exhaust gas volume as the driving modes change. The end result of each test is two numbers which are meant to define what the over-all emissions from the device would be if a great number of similar cars were so equipped and used in a completely random way by the general population.

All 25 devices will be driven on the road until each one exceeds either the 275 ppm hydrocarbon limit or the 1·5 volume per cent. carbon monoxide limit according to the dynamometer test. After all 25 cars have reached these maxima, the data from all will be pooled and device acceptability will be judged on its average performance in the entire test car fleet.

While this test procedure answered most of the questions which had existed prior to May, there were, and still are, several thorny uncertainties. From May to September, a debate centered around the question of whether the 275 ppm HC and 1·5 per cent. CO criteria should mean: (*a*) that when a device had exceeded these values, it was immediately off specification and hence to be terminated, or (*b*) that a device was acceptable until the time when the average emissions during its entire life span reached these limits. This is extremely important, for if the latter be true, then the acceptable life-span of any given device would greatly exceed that under the first interpretation. Just last month, the Board decided that the emission criteria were to be used as absolute maxima, and again companies working on device development retured to their research laboratories.

A still unsettled problem involves the composition of the 25-car test fleet. Although the California regulations group engines into six classes according to piston displacement, and permit developers to submit modified devices to qualify in each class, cars within each class often have widely different emissions due to age, condition, maintenance practices and basic design concepts. To find 25 cars which truly typify the entire California automobile population of over six million vehicles is a formidable problem. At the moment, there is still considerable disagreement as to what constitutes typical emissions from this vast group of cars.

**Qualitative Criteria**

Earlier, I mentioned that the California Board has also adopted qualitative criteria concerning safety and reliability. Such criteria are necessary because of the close proximity of people and property to an automobile in use. These were established just two weeks ago, and are categorized as " Step II Testing." Assuming that a device has successfully passed " Step I Performance Testing," it will then be subjected to examination to determine: that it will not interfere with safe performance of the brakes, the fuel tank and fuel line, or the transmission; that it will withstand at least six severe backfires without structural failure; that it will not allow noxious fumes to enter the passenger compartment; that it will not emit excessive heat from the tailpipe; that it will not increase engine back-pressure by more than 25 per cent. over that of a conventional muffler; that it will be able to withstand immersion in water at operating temperature and then resume satisfactory operation after a 24 hour dry-out; that it can pass through high, dry grass without creating a fire hazard; that it will not create excessive noise or objectionable odour; and lastly, if and when it does fail, that it will fail in a safe manner.

While many of these quantitative criteria are not new in principle, their very recent adoption in well-defined detail makes it unlikely that any company can be certain at this time that its device is completely acceptable.

I stated before that the uncertainties upon which some of the performance criteria are based have tended to retard the speed with which acceptable

exhaust control devices can be developed. This is an unavoidable fact, not a complaint. Technically, sound criteria cannot be established without adequate data from which to work. But in many cases the necessary incontrovertible data simply do not exist. To await the accumulation of such data would be to indefinitely postpone relief from air pollution by automobiles. As a result, the Staff of the California Board has sometimes found it necessary to draw conclusions and to set criteria on the basis of evidence which other competent experts might view differently. The Staff has conscientiously sought the advice of competent technologists and has carefully weighed their opinions before making final decisions. These discussions and considerations must take time if the results are to be fruitful. We share with others the opinion that the California MVPCB has acted judiciously and with reasonable speed, considering the complexity of the problem.

Perhaps these generalizations will have more meaning if several fundamental facts are appreciated. The sole objective of the California Board is to reduce air pollution by automobiles and thus to eliminate this aspect of smog formation. Their problem is to define what must be done to accomplish this objective, but not to determine how this is to be done. As a result, performance criteria must be based only on the premise that subsequent compliance would in fact eliminate this aspect of smog, not on whether any means is presently known for meeting the criteria.

To arrive at a definition of what had to be accomplished, it was first decided that air of the quality which existed in the Los Angeles Basin in 1940 would be acceptable, and the quality of this air was defined in terms of its content of hydrocarbons and carbon monoxide. It was next assumed that an exhaust control programme could not be made completely effective before 1970. By projecting the growth of the automobile population to that year, and using the data available on the quantities of hydrocarbons and carbon monoxide emitted by automobiles, it was calculated that the total hydrocarbon emission from automobiles would have to be reduced by 80 per cent., and the total carbon monoxide emission reduced by 60 per cent. if the air quality of 1940 were to be achieved. The next step was to determine what the present average hydrocarbon and carbon monoxide emission is per vehicle in order to translate per cent reduction into absolute values. Studies indicated that the average car emitted 1,375 ppm hydrocarbons and 3·75 volume per cent. carbon monoxide during a typical trip. Reducing these emissions by 80 per cent. and 60 per cent. respectively leads to the present standards of 275 ppm and 1·5 vol. per cent.

The foregoing reasoning is straightforward and sound. But the numerical specifications which result are nevertheless no more accurate than the masses of data on which each step in the reasoning is based. For example, is it really true that California's automobiles do average 1,375 ppm HC and 3·75 per cent. CO at the tailpipe? The limited surveys from which this conclusion was drawn are far from reliable. Similar doubts exist at each step along the way. The California authorities are fully aware of these uncertainties. Hence in setting up the actual performance standards, they have made certain that these shall be conservative, to maximize the likelihood of achieving their single objective in spite of the known uncertainties. This is probably why the Board decided that the standards of 275 ppm HC and 1·5 per cent. CO should be interpreted as absolute maxima rather than averages over the life of a device. This is probably why each dynamometer test of a device is begun with a cold engine, even though it is known that not every trip in private vehicles is from a cold start.

Having outlined the many types of problems which any device developer must face, the logical question is where do we now stand? Can a device be

developed which will meet all criteria? If so, how soon? And will the cost be reasonable? In considering these questions, I must necessarily reflect our own progress, although general conversations with others similarly engaged do have their weight. Speaking for the Grace organization, we do believe that a practical device which will meet the California criteria can be developed. As testimony to this viewpoint, we are continuing a research and development programme which is very substantial in terms of both money and manpower. This is not an expression of blind optimism, but is based on our present technological developments.

On the subject of how soon devices may be available on cars in California, a reasonable estimate of the earliest date is possible. Since the California Board has not yet accepted any device prototypes for " Step I Testing," and since the Board's test car fleet has yet to be assembled, one can guess that Step I Testing of any device is not likely to begin much before January 1, 1962. Step I plus Step II Testing might easily take six months, with the earliest certification occurring late in 1962. But installation will not be mandatory until two devices have received certification. If we ignore this complication by assuming that two devices will be approved at about the same time, or by assuming that the automobile manufacturers will voluntarily install a device as soon as it is certified, then the lead-time required by the automobile manufacturers becomes controlling. Certainly, this must be at least one model year. So we arrive at the inescapable conclusion that an exhaust control device will not appear on new cars in California before the 1964 models. How much later than this will depend upon the degree of optimism in the above assumptions, plus the rate of technological advancement.

How much will the device cost the new car buyer? I doubt whether a reasonable estimate can be made at this time. There are still many imponderables. The increasingly stringent criteria set by the California Board have necessitated devices of increased sophistication, and real costs have undoubtedly been affected upward. While device manufacturers may have early thoughts on costs to them, nothing can yet be known of installation costs, since car manufacturers have no knowledge on the nature of the devices which will be approved. Device certification can be refused by the CMVPCB on the basis of unreasonable cost. The Board, in its deliberations, has given an inkling that cost is to be judged in terms of cents per operating mile, and this should be in the range of other necessary automobile replacement parts such as tyres. Using a tyre cost of $100 per set with a life of 20,000 miles, a typical operating cost for tyres would be $\frac{1}{2}$ cent per mile. At this same rate, an exhaust control device with a life of 12,000 miles would cost $60. Since a conventional muffler valued at about $20 would not be required, it is possible that a gross installed cost of $80 for the exhaust control device would be acceptable.

These, then, are the problems of those engaged in the development of automotive exhaust control devices. I believe they will be solved and that the California programme will be successfully implemented. This means that devices will have to be installed on new cars no later than fall of 1966.

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**Chemistry of Air Pollution**

The American Chemical Society's Committee on Air Pollution has adopted as a central theme, the Chemistry of Air Pollution, for a symposium to be held during the 142nd national meeting in Atlantic City, 9th to 14th September. The programme chairman is Dr. Morris Katz, Ottawa, Canada.

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The village of Arance in the lower Pyrenees is condemned to disappear. Owing to the dangers of air pollution resulting from the extraction and treatment of natural gas in the neighbouring Lacq area, the government has advised the two hundred inhabitants to evacuate.

*Review*

# *Windborne Pollution*

**Atmospheric Pollution. By F. Pasquill. pp. 297, 60s. net. D. Van Norstrand Co. Ltd., London.**

This important text-book by Dr. Pasquill of the Meteorological Office deals with the physical aspects of the behaviour of windborne materials in the atmosphere. The problems are physical and the major part of the book consists of their discussion in detail. Proceeding from a review of the analysis of turbulence and diffusion, the author assembles a wealth of data derived from old and recent experiments and provides a study which as a survey of basic research, will interest the meteorologist, and as a guide to the assessment of dispersion, will meet the needs of other scientists concerned with air pollution.

The complex spreading effect to the atmosphere, which is evident in the variable appearance of a plume of smoke from a factory chimney, is the basic problem investigated. In his examination the author emphasizes the statistical concepts of turbulence, which have been developed in the fields of fluid mechanics and aerodynamics.

In his final chapter Dr. Pasquill discusses the distribution of windborne material from real sources, and this contains much information of general air pollution interest. The rise of the hot effluent and the deposition of airborne material are considered, followed by studies of the distribution of the effluent in the neighbourhood of single stacks. Other factors in the incidence of air pollution are reviewed, together with an examination of the travel and deposition of radioactive material. Finally, there is a section on agricultural, botanical and related interests. These are of considerable practical importance and do not as yet appear to have received all the attention they deserve. There is thus the question of the airborne spread of plant diseases, the effects of chemical spraying of crops from the air, and the dispersal of insect swarms.

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## 100 Years Ago

" Stokers and the Smoke Nuisance "

" The best furnace in the world will not consume its own smoke unless it is properly attended to; and the error committed by manufacturers consists in not employing proper persons to attend the fires. It may be taken as an incontestible truth, that there is no smoke consumer like a good stoker. Manufacturers would consult both the public convenience and their own interests by engaging none but careful and well-qualified stokers. There is a very simple lesson which, as a rule neither the stokers nor their employers seem to have mastered. It is this. The first effect of heat upon coal is to drive off the gases contained in the coal. These gases, when unburnt, constitute the clouds of black smoke so generally emitted by manufactory chimneys; and thus, while the air is poisoned and loaded with matter dangerous to health, a considerable part of the heating properties of the coal is altogether wasted. The gases which are thus rendered harmful may be very easily economised by passing them over a body of fire, and thus burning, as fuel, the smoke now poured out into the atmosphere. If the stoker, in doing what is called ' firing ' the furnace, will only take care to put on the coal in front and in small quantities, at the same time pushing back the ignited fuel and properly regulating the supply of air, the smoke will be entirely consumed, and the quantity of coal used on the present wasteful system will be greatly diminished. All that is required is greater care and intelligence on the part of the stokers; but in order to secure this a better class of men must be employed."—*From " The Engineer," August* 30, 1861, *reprinted* 1961.

# 150 Years Ago

*Is it impossible to free the Atmosphere of London in a very considerable degree from the Smoke and deleterious vapours with which it is hourly impregnated?*

This plaintive question was posed by an anonymous writer as the title of a tract written and circulated at around 1810. He disapproves of the Londoners' acceptance of their smoke. " The Hottentot returns to his grease: but I believe that if the smoky atmosphere of this great city was exchanged for a purer air, none would lament loss of their black fog. All talk of the smoky town; but they sit contented under their dense vapours, from an opinion that the evil is incurable." Each improvement is at first considered impossible—for example it was first thought essential that in Bedlam the unhappy patients had to be kept by immense locks bolts and chains, but modern reforms were made in New Bedlam and so an application of some common sense would produce similar improvements in other fields.

The author describes the effect of the " vomitories of smoke " seen by any observer standing on Blackfriars Bridge, and he considers that industrial chimneys are the greater offenders. " I conjecture, that the smoke occasioned by a vast variety of manufactories, forges, glass-houses, etc., is at least three times as great as that proceeding from all the chimneys for family use: and it is to be recollected that some of these furnaces issue forth matter of a most deleterious nature."

Well in advance of his time, the writer is concerned about the medical aspect of air pollution—" the mischief arising from noxious vapours " and is dismayed that so little attention is paid by legislature to this subject. He describes how a green lane in London, his favourite walk was ruined by the erection of two furnaces with chimneys less than ten feet above the roof. In contrast another manufacturer built a high chimney " and with what advantage, both to himself and to the publick, the very meritorious engineer, the owner of them, had constructed his works." An individual making a fortune by his works should not inconvenience his neighbours, but this principle was almost entirely neglected in and around London.

The remedy put forward by the pamphleteer is that the height of chimneys should bear some proportion to the quantity of coals consumed in the furnaces beneath. He suggests that half way up the chimney there should be apertures with flues to run round the building before passing the smoke through several vents in the upper chimney.

The author concludes " that the smoke emitted by the vomitories, may be greatly reduced in quantity; that the expence of doing it is trifling in comparizon of the profits of the works; and that the Legislature will not be ill-employed in taking such measures as shall secure the publick from its present nuisance." The writer could not know that he was being prophetic about a Government Committee 144 years later, when he advocates that an inquiry should be made into furnaces, the coal consumed and the expense incurred by adopting his recommendations. Such an inquiry would also ascertain whether old works should be partly subsidised by public funds and lastly to prevent any new works " unless on regulations adopted on the principle, that a furnace should not be permitted to emit more smoke than a common chimney."

Finally, " These hints are thrown out with a view of exciting some persons to take this matter into consideration. A few copies only have been printed for the use of Writer's friends, and for some members of the Legislature, to whom he has taken the liberty of submitting them. They are merely hints; but if a Committee of the Legislature should be appointed to examine this subject, he has no doubt, that the light, thrown upon it by engineers and manufacturers will show that the diminution of the smoke of London will be highly beneficial."—*V.F.*

# ROAD POLLUTION AND TRAFFIC CONGESTION

## *A Way to Reduce Both*

*The attention being given to reducing air pollution on the roads should not overlook the important contribution that can be made by a greater use of smokeless and fumeless electric traction, and we are pleased to print this informative article from a Special Correspondent*

EVERY year, almost every day, traffic congestion increases and accompanying it is an increasing density of exhaust pollution in the atmosphere from which there is no respite. Unlike the pollution from space heating fires and furnaces only used for some six months each year, this low level pollution in walled-in town streets is present in the summer as well as in winter.

It is a pity that all exhaust gases are not naturally coloured because " what the eye doesn't see the heart doesn't grieve about " is still very true; thus everyone concentrates on smoke from diesels and assumes that the cure for the pollution from these engines is the elimination of their smoke, whereas the invisible constituents, the oxides of nitrogen and sulphur and the aldehydes are the most offensive.

### No Cure in Sight

The problem of pollution is not likely to be solved by simple exhaust filters. Equipment akin to a small chemical works is necessary to deal with all the harmful constituents of engine exhausts.

It is interesting that in a paper on " Road Vehicle Engine Fumes " presented to an international conference in Brussels in 1958 by the Director of Research of the London Transport Executive the following admission appeared: " Even under conditions of perfect combustion, if such could be achieved, internal combustion engines must lead to pollution of the atmosphere by carbon dioxide, sulphur gases and oxides of nitrogen, but this is a situation which has to be accepted."

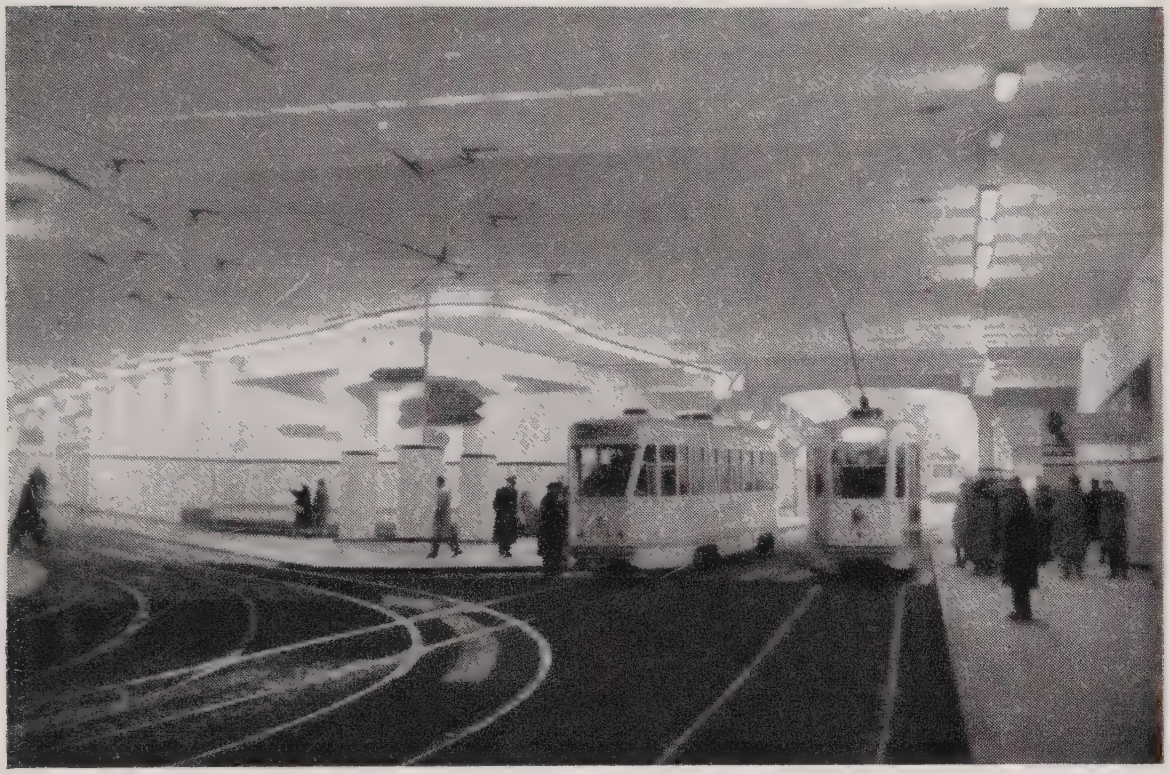
Many members of the medical profession are greatly concerned over this problem and in a debate on the subject of diesel fumes at the Annual Representative Meeting of the British Medical Association last year a resolution was adopted urging the Government to take more active steps to reduce this form of air pollution, particularly in urban areas. In the debate it was suggested that the Government could take note of the practice of many European countries of encouraging the use of electric traction for public transport, which brings to the fore the obvious fact that in order to reduce atmospheric pollution electric vehicles should be used to the maximum possible extent.

Official information received from Moscow regarding the use of trolleybuses stated that " buses with diesel engines are not being used on the internal municipal bus routes because the engines contaminated the air with exhaust gases."

It is most interesting that the sole reason given for using trolleybuses on the internal bus routes was because they do not pollute the air. When considering this fact we should bear in mind that Russia, unlike ourselves, possesses much indigenous oil, which makes the contrast with the policy of many places in the U.K. of replacing trolleybuses with air polluters most ill-advised.

### A Means of Big Reduction to Hand

A method of traction offering a



*Public transport relieving traffic congestion and air pollution. Under-street tramway station in Brussels*

positive reduction in atmospheric pollution and traffic congestion in large cities and towns ought surely to receive wide local and national Government support. Electric traction offers both advantages.

Traffic congestion became acute in the large cities and towns of the U.S.A. before it did here. The Americans concluded they could solve the problem by one-way traffic arrangements and by building more and bigger roads into and through towns. These measures brought only temporary relief because the new roads attracted more vehicles and congestion soon became as bad as ever and the provision of more facilities for more motor vehicles naturally increases air pollution and another menace to health, noise. Following such results, the view is growing in America that public passenger transport in large towns must be made so comfortable and rapid that the " commuter motorist " will be attracted to it and leave his car on the outskirts. The only public transport that is fully effective in this way is electric railed transport which makes the most economical use of restricted space. Chicago is one of the towns using this system and is to extend it. These modern electric rail car systems with their own reserved tracks have been named by the Americans, " Rapid Transit."

A Planning Commission for Washington proposes in its latest measures a rail network of 33 miles of double track on four routes radiating from the centre and running in tunnel in the down town area but further out occupying the central section of motorways or having their own right of way.

Fully signalled railway systems are not always needed, the rail cars being driven on vision alone. In fact modernized tramways fill the need in a great many places abroad; Brussels has largely modernized its tramways system so that it runs on reserved track or in shallow subways in many parts of the city and is thus not retarded by other traffic.

A few amongst the many other large European cities and towns whose basic transport needs are met by modernized tramway systems are Oslo, Gothenburg, Amsterdam, Dus-

seldorf, Frankfurt, Stuttgart, Milan, Zurich. The four last named are to put some of their tram routes underground. Montreal is to adopt a railed system of electric transport and Toronto has a modern electrified rail car system and so has Melbourne.

**January 29**

Had it not been for much foresight in the past, London would not possess its underground railways, nor the electrified Southern Region system and traffic would have reached the stage of complete stagnation long ago. We had a first taste of it this year on Monday, January 29, when the strike of London Underground train drivers occurred. London still needs much more electric railed transport to ease its traffic and air pollution problems and this type of transport is the urgent need of many of our large cities and towns. Such needs cannot, however, be financed by local transport undertakings which hitherto has been the outlook. The cost of such transport improvements will have to be financed, like road works, as city or town improvements in order to ease the community's problem of air pollution and traffic congestion.

The traffic committee of the International Union of Public Transport in a brochure entitled " There is still time to prevent traffic from strangling our towns " stresses the need for high capacity, fast and comfortable public transport as the measures needed and points to the railed system as meeting these needs whilst occupying the least space per passenger carried.

For much of the public passenger transport in urban areas, the trolleybus has supreme advantages recognized in many parts of the world and still in some places in this country. If a public vote had been taken, it can be safely said that very few, if any, abandonments would have occurred and much subsequent public dissatisfaction would have been avoided.

The trolleybus, in common with all electrically powered transport, has the highest acceleration per horse power; it is smooth, silent, fumeless. It provides the comfort that the best judges, the passengers, desire and appreciate. It is, of course, route-bound, but so is all public transport serving main traffic arteries. One would not expect to use this type of vehicle as a motor coach.

In many cities and towns in the U.K. much injustice has been done to electric public transport through the standard method of costing which presents a distorted picture. An item which has nothing to do with the efficiency of the vehicle is the greater burden of rates levied on trolleybus systems which can amount to as much as a penny a vehicle mile more than for a diesel bus. This, naturally,



*One of Gothenburg's new two-car sets accommodating* 240 *passengers. No air pollution, and maximum economy in road space per passenger*

doesn't help the trolleybuses but it does help the local ratepayers.

A large city in its transport accounts shows nearly 5d. a mile more for drivers and conductors wages in running a trolleybus as against a diesel. The crews' wages are the same for both vehicles. A senior officer of the city reported that trolleybuses had lost their financial advantages. With a standard costing system providing such anomalies, statements of this kind are nonsensical.

**Battery Vehicles**

The greater use of battery electric vehicles would also reduce air pollution and noise in our towns. Very many more could be brought into use with great savings for the user and benefit for the nation. In transport there is a great deal of waste; too often the wrong type of vehicle is used for a particular job of work.

One doesn't need an elephant to carry a sack of potatoes or an express locomotive to shunt coal trucks.

Examples of less obvious but equally out of balance transport usage surround us. There are very many engine-driven vehicles capable of 60 miles an hour used on short-haul city and town work which could, with great savings for the owners, be replaced by battery electric vehicles. These have a lower maximum speed but it is high enough for traffic-congested city streets and acceleration is so good that they lose nothing in average speed; indeed in urban work the electric often maintains a higher average speed.

Vehicles and trucks used in traffic or in factories have to start and stop many times a day. When " electrics " stop they do so completely. There is no waste of fuel in idle running or unnecessary wear and tear on the power mechanism.

When running, the electric traction motor has only two metal-to-metal wearing parts, namely two bearings, in contrast to the very many moving parts producing friction in an engine. The power unit of the " electric " is therefore simple, which is a great advantage in these days of shortage of skilled mechanics.

The simplicity of the " electric " and its easy maintenance results in much less lost time for attention and overhauls. A vehicle's lost working time is often not shown in transport or handling costs but it represents serious monetary loss.

The life of vehicles is a big item in transport and handling costs and, in this regard, " electrics " have a life at least double that of other types which should be taken into account when any cost figures are put on paper. Electric vehicles are so less liable to accident that insurance premiums are reduced by 25 per cent.

The time is overdue for us to revise our ideas on transport and to realise that electric transport is the one means to hand for reducing both atmospheric pollution and traffic congestion in large cities and towns.

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**Birmingham a Testing Ground**

A new laboratory in Moseley Street, Birmingham, has been opened by Frederick Mountford (Birmingham) Ltd., a member of the G.K.N. group, to study the corrosion of nuts, bolts, screws and other engineering fastenings. Among the many tests to be carried out is an atmosphere test in which articles are suspended in the open air on the roof of the building. It is considered that the atmosphere of Birmingham is a perfect " natural " condition for testing the corrosion of metal products.

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**Bonfires to Go**

A ban on garden and allotment bonfires is to be imposed on council house tenants in Hebburn U.D.C. The Council had been considering a letter from the Northumberland and Durham Clean Air Committee of local authorities, which supported the view of Professor F. C. Pybus that the burning of garden refuse was harmful and a contributory cause of cancer. Tenants are being recommended that refuse should be composted or otherwise disposed of, and similarly no refuse is in future to be burnt in the public parks.

# SMOKE CONTROL AREAS

## Progress Report

### POSITION TO DECEMBER 31, 1961—TOTALS

| | England and Wales | Scotland |
|---|---|---|
| **Smokeless Zones** (Local Acts) in Operation.. Acres, 3,400 Premises, 41,060 | 44 | 1 |
| **Smoke Control Areas in Operation** .. .. Acres, 100,347 Premises, 561,692 | 517 | 16 |
| **Smoke Control Orders—** | | |
| Confirmed .. .. .. .. .. | 217 | 7 |
| Submitted .. .. .. .. .. | 128 | 7 |
| **Grand Totals** .. .. .. | 906 | 31 |

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Winter, 1961), which give the position up to September 30, 1961. They now show the changes and addition to December 31, 1961.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

### ENGLAND AND WALES

#### New Smoke Control Areas in Operation

Acton B. No. 4, Aireborough U.D. No. 6, Barnes B. No. 1, Barnsley C.B. No. 2, Beckenham B. No. 1, *Beddington and Wallington B. No. 1, Beeston and Stapleford U.D. No. 1, Bermondsey M.B. No. 3, Bethnal Green M.B. No. 2, *Billingham U.D. No. 1, Birmingham C.B. Nos. 7 to 9, *Bolton C.B. Nos. 6 to 7 and 9 to 14, Bootle C.B. No. 3, Brentford and Chiswick B. No. 2, Brighouse B. No. 2, *Bristol C.B. No. 6, Bromley B. No. 3, *Burnley C.B. No. 1, Bury C.B. No. 2, Carshalton U.D. No. 1, *Chadderton U.D. No. 2, Cheadle and Gatley U.D. No. 1, Cheshunt U.D. No. 1, Crawley U.D. No. 2, Crayford B. No. 1, Croydon C.B. Nos. 2 and 3, Dagenham B. No. 2, *Dartford B. No. 1, Deptford M.B. No. 2, Dewsbury C.B. No. 3, Ealing B. No. 5, East Barnet U.D. No. 2, Eccles B. No. 1, Edmonton B. No. 3, *Ellesmere Port B Nos. 2 to 4, Enfield B. No. 2, Feltham U.D. No. 1, Fulham M.B. No. 4, *Grantham B. Nos. 1 and 2, Hackney M.B. No. 3, Halesowen B. Nos. 1 and 2, Halifax C.B. No. 5, Hampstead M.B. No. 3, Harlow U.D. No. 1, Hayes and Harlington U.D. Nos. 9 and 15, *Heckmondwike U.D. No. 1, High Wycombe B. No. 9, Holborn M.B. No. 4, Hornsey B. No. 3, *Huyten-with-Robey U.D. No. 1, *Irlam U.D. No. 1, *Kensington M.B. Nos. 2 and 4, Kingston-upon-Hull C.B. Nos. 4 to 8, Lancaster B. No. 1, *Leek U.D. No. 1, *Leicester C.B. Nos. 4 to 6, Leyton B. No. 1, *Liverpool C.B. Nos. 10 to 12, Manchester C.B. No. 3, *Middleton B. Nos. 2 to 6, *Mirfield U.D. Nos. 1 to 3, Newburn U.D. No. 2, *Newcastle-under-Lyme B. No. 1, Northfleet U.D. No. 1, *Oldham C.B. No. 1 and 2, Poplar M.B. Nos. 1 to 4 and 6, Prescot U.D. No. 1, Reading C.B. Nos. 3 to 7, Runcorn U.D. No. 1, Selford C.B. No. 1, *Sheffield C.B. Nos. 2 and 5, Shoreditch M.B. No. 2, Slough B. No. 1, Southampton C.B. No. 1,

Southwark M.B. No. 1, St. Marylebone M.B. No. 4, St. Pancras M.B. No. 3, Stoke Newington M.B. Nos. 5 and 6, Stoke-on-Trent C.B. Nos. 1 to 6, *Stretford B. No. 1, Sunderland C.B. Nos. 2 and 4, Swinton and Pendlebury B. No. 1, Wandsworth M.B. No. 3, *Wanstead and Woodford B. Nos. 1 and 2, Warrington C.B. Nos. 3 and 4, Wembley B. No. 1, Westminster M.B. Nos. 4 and 5, Whitefield U.D. No. 2, Willesden B. No. 3, Wolverhampton C.B. No. 1, Wood Green B. No. 3, Woolwich M.B. Nos. 7 and 8, 10 and 11, Worsley U.D. No. 2, Wortley R.D. No. 4, Yiewsley and West Drayton U.D. No. 2.

**New Orders Confirmed but not yet in Operation**

Ashton-under-Lyne B. No. 4, Barnet U.D. No. 3, Birmingham C.B. Nos. 21 to 33, 39 to 47, 51 and 52, Bolton C.B. Nos. 16 to 18, Bredbury and Romiley U.D. No. 2, Brighouse B. No. 5, Camberwell M.B. No. 2, Colne B. No. 1, Crewe B. No. 1, Dagenham B. No. 3, Doncaster C.B. No. 6, Dudley C.B. No. 4, Dukinfield B. Nos. 2 and 3, Ealing B. No. 7, Eccles B. No. 3, Edmonton B. No. 4, Finchley B. No. 6, Finsbury M.B. No. 2, Grantham B. Nos. 3 to 6, Hammersmith M.B. No. 3, Hebburn U.D. No. 3, *Heckmondwike U.D. No. 2, Heston and Isleworth B. No. 3, *Hindley U.D. No. 1, Islington M.B. Nos. 5 and 6, Kensington M.B. No. 5, Kirkby U.D. Nos. 1 and 2, Leeds C.B. Nos. 6 to 19, Leyton B. No. 2, Maldon and Coombe B. No. 1, Merton and Morden U.D. No. 2, Middlesbrough C.B. No. 2, Morley B. Nos. 8, 9, 11 and 12, Oldham C.B. No. 3, Penge U.D. No. 1, Pontefract B. No. 2, Preston C.B. No. 5, Queensbury and Shelf U.D. No. 1, Salford C.B. No. 5, Shoreditch M.B. No. 4, St. Marylebone M.B. No. 5, Stoke Newington M.B. No. 7, Swinton and Pendlebury B. No. 2, Westminster M.B. No. 6, Willenhall U.D. Nos. 10, 12 and 13, Woolwich M.B. Nos. 9, 12 and 13, Yiewsley and West Drayton U.D. No. 3.

**New Orders Submitted for Confirmation but not yet Confirmed**

Aldridge U.D. Nos. 6 to 12, Ashton-under-Lyne B. No. 3, Audenshaw U.D. No. 2, Barking B. Nos. 2 and 3, Batley B. No. 2, Bebington B. Nos. 3 to 7, Beeston and Stapleford B. No. 2, Bermondsey M.B. No. 4, Birmingham C.B. Nos. 6, 35 to 38, 48 to 50, 53 to 60, Blackburn C.B. No. 2, Brighouse B. No. 6, Bury C.B. No. 3, Cambridge B. No. 1, Carlton U.D. No. 1, Carshalton U.D. No. 2, Chadderton U.D. No. 3, Chatham B. No. 1, Cheshunt U.D. No. 2, Chesterfield R.D. No. 2, Coventry C.B. No. 3, Crawley U.D. No. 3, Crompton U.D. No. 2, Croydon B. No. 4, Dartford B. No. 2, Deptford M.B. No. 3, Derby C.B. No. 2, Dewsbury C.B. No. 4, Exeter C.B. Nos. 4 to 6, Failsworth U.D. No. 2, Feltham U.D. No. 2, Friern Barnet U.D. No. 2, Fulham M.B. Nos. 5 and 6, Greenwich M.B. No. 3, Hackney M.B. No. 4, Harrow B. No. 2, Hayes and Harlington U.D. No. 21, Hazel Grove and Bramhall U.D. No. 1, Hendon B. Nos. 2 and 3, Heston and Isleworth B. No. 2, *High Wycombe B. No. 10, Holborn M.B. No. 5, Huddersfield C.B. No. 5, Hyde B. Nos. 2 and 3, Kingston-upon-Hull C.B. No. 9, Kingston-upon-Thames B. No. 2, Leamington Spa B. Nos. 9 and 10, Leicester C.B. No. 7, *Leigh B. Nos. 1 and 2, Lewisham M.B. Nos. 10 and 11, Lincoln C.B. No. 1, Malden and Coombe B. No. 2, Manchester C.B. No. 5, Mansfield B. No. 2, Mirfield U.D. No. 4, Mossley B. No. 1, Nottingham C.B. No. 2, Nuneaton B. No. 1 (Part 2), Ossett B. No. 2, Padiham U.D. No. 2, *Prestwich B. No. 4, Pudsey B. No. 3, Richmond (Surrey) B. No. 3, Sheffield C.B. No. 9, Shipley U.D. No. 2, Slough B. No. 2, Staines U.D. No. 2, Stepney M.B. No. 3, Stoke-on-Trent C.B. No. 12, Stretford B. No. 2, Thurrock U.D. No. 1, Todmorden B. No. 1, Tottenham B. No. 3, Walsall C.B. No. 4, Walthamstow B. No. 3, Wakefield C.B. Nos. 3 and 4, Wanstead and Woodford B. No. 3, Wembley B. Nos. 2 to 5, *Westhoughton U.D. No. 2, Westminster M.B. Nos. 7 and 8, Wetherby R.D. No. 1, *Whitefield U.D. No. 3, Willesden B. No. 4, Wilmslow U.D. Nos. 7 and 8, Winsford U.D. No. 3, Wolverhampton C.B. Nos. 2 and 3, Wood Green B. No. 4, Woolwich M.B. No. 14.

## SCOTLAND

**New Smoke Control Areas in Operation**

Dunbarton Burgh No. 1, Dundee (Balgay, Camperdown and Whitfield).

**New Orders Confirmed but not yet in Operation**

Clydebank No. 2 (Mountblow), Motherwell (Forgewood).

**New Orders Submitted for Confirmation but not yet Confirmed**

Dundee (West End).

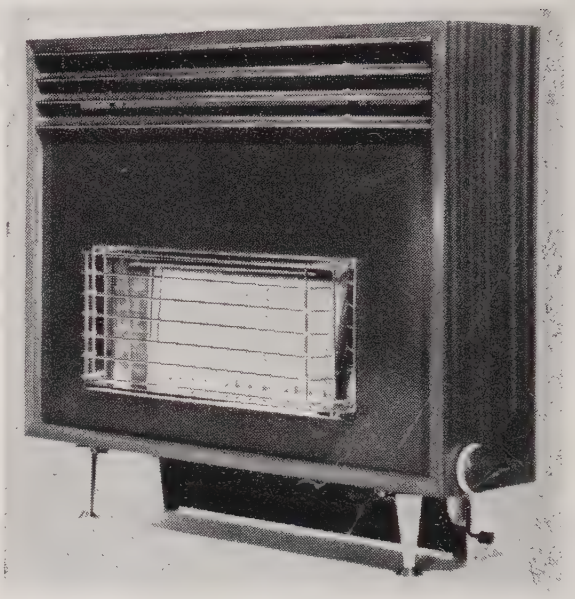
# *The New Gas Room Heaters*

## Success of the Debonair

As has been stressed in this journal before, the greater the contribution that can be made to domestic heating by central heating, gas, electricity and oil, the easier will it be to cope with the rising demand for open fire solid smokeless fuels that must accompany the further extension of smoke control areas—most of which is yet to come. Gas, apart from its share of the growing whole-house warming trend, can now play a more important part than had been expected in these developments. The old type of gas fire, relying entirely on its radiation, has now been completely superseded by the new part radiation, part convection, room-heaters. With these the cost of heating a room is brought down to, or below, the cost of the traditional open coal fire; to say nothing of the value of their cleanliness and labour-saving. And not only is the cost well down, but the combination of radiation and convection, with ventilation through adequate but not excessive air changes, gives a remarkably fresh and comfortable form of heat.

There are a number of such room heaters now on the market, the first of which, and still going strong, is the " GasMiser." As readers should have noted from the Cannon advertisements in this journal, this has had a sale to date of over 250,000. It was reviewed in our Spring, 1956 (No. 97) issue. Other well-known models include the Main " Selsdon," " Century " and " Romany " heaters, the Sugg " Queen Convectair," the Bratt Colbran " Flamborough " and the Radiation " Sunbeam."

The heater that has created unusual interest, and been given much praise and publicity, this last winter is the " Debonair," made by Sidney Flavel and Co. Ltd. of Leamington Spa. It is, to begin with, outstanding in its design, and the maker's claim that it is the first heater to be designed as



*The Debonair*

furniture is no exaggeration. It was designed by a prominent design consultant, Donald McFall, in association of course with Flavel's own technical team, and apart from the attractiveness of its appearance, the width of the convector louvres is of importance for the efficiency and distribution of the flow of warm air. The wooden surround is a unique and attractive feature, as is the dark blue colour of the vitreous enamelled facia.

Ignition and control of the fire is very simple. A tap at the side of the fire, spring-loaded for safety, is turned to " IGN " and a battery-operated filament ignites the gas. The tap turns itself back to " full," or it can be turned to " low." At full the whole fire is in operation; at low only the centre third. Intermediate settings can of course be obtained as desired. The battery (a U2 leakproof) for the ignition needs renewing only once a year.

The fire is rated as a gas input of 16,500 Btus. per hour, and has an output of 11,900 Btus. per hour, divided equally between radiation and convection. It thus has a useful

thermal efficiency of about 72 per cent.

From personal experience, with gas costing 18d. per therm (standing charge on a two-part tariff not included) this works out at less than 3d. per hour with the gas full on, or about 1d. per hour with the tap set low.

The agreeable surprise in testing a Debonair domestically (in a room of 1,600 cu. ft.), is for what a short time the full heat is normally required, even in very cold weather. On nearly all days during the month of January a half-hour at full, followed by " low " was found adequate. The room temperature would rise by 8°F. in thirty minutes or so, and during milder weather (outside temperature around 45°F. warmth could be maintained at even half " low." The marker's " freshness " claim was fully substantiated, and was praised by other users as " a sort of spring-like warmth."

Another feature of the heater is an additional ventilation control—an adjustable flap under the fire, which can be closed or opened to allow air to pass directly into the chimney. This can be used even when the fire is not in use, as during the summer.

Flavel's are to be congratulated on this excellent appliance. It may be of interest to recall that they introduced what we believe was the first open fire especially designed to burn coke, the " Metro," and which was advertised in this journal in its earliest issues, over thirty years ago.

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*The Editor,*
*Smokeless Air*

## EDUCATION FOR CLEAN AIR

Sir,

I found the article " Parallel Paths " (*Smokeless Air*, Autumn, 1961) most interesting and informative although I was not really so very surprised to find that the basic outlook in this type of social reform has not really changed in 100 years. Anyone active in the campaign for Clean Air must have come against the same miserable and pathetic arguments in defence of the domestic coal fire as I have and must at times wonder, as I do, if any measurable standard of citizenship really exists.

I was glad too that reference was made to the need not only for the availability of information but also the need to " put it over " to the public generally and that in this connection such organizations as Ratepayers Associations can usually be helpful. Approach in this direction seems really sound to me for it should be reasonable to assume that it is in such associations that those citizens who have a real sense of social responsibility are most likely to be found. If they in turn could be inspired to set the example to their neighbours by " going smokeless " a real inroad to the problem could be made.

This is not to say that I am unmindful of the propaganda value of advertisement. I would like to see my city " plastered " with hard hitting posters and have already put forward suggestions in this connection but " Clean Air " seems such an intangible subject to so many citizens and so seeped in tradition are their habits, that a propaganda campaign, to be effective would need to be very carefully planned and be on an extensive scale. It would be doubtful then whether local authorities could raise the necessary funds. It is regrettable that the Clean Air Act has not made greater provision for this approach.

As with so many basic issues in human life, the real problem seems one of social democratic education. People are all too ready to seize the benefits that civilization can offer them, but are not so ready to meet their own obligations to the community.

Yours faithfully,

A. HALL

# New Smokeless Incinerator

The Hoskinson smokeless incinerator, manufactured by the Boston Marine & General Engineering Co. Ltd., of Wolverhampton, is now well known, and many readers will remember its first appearance at the Society's exhibition at Harrogate in October, 1960. This model is intended for dry combustible materials, which it consumes entirely without smoke.

There has now been introduced a new model, the B.100, which has been designed especially to consume wet or putrescent material. Although basically similar to the other model in its smoke eliminating after-burner, it has a gas burner for the ignition of the material, integrated with a specially designed grate of conical design. The wet refuse is simply loaded into the furnace from above and smokeless combustion proceeds without further attention.

The B.100 was "inaugurated" recently at Scunthorpe, when one was installed at the public market and ceremonially started by the Mayor of Scunthorpe, in the presence of a party of guests who included public health and markets representatives, technical people and the press. The incinerator was loaded with the contents of a number of bins of market refuse, including vegetable and fish waste, and so on—the Mayor himself assisting—and apart from a little vapour for the first minute the incinerator stack was completely free from visible emission. Having seen the stuff that went in, this was a remarkably convincing demonstration.

The disposal of wet—and often unpleasant—material is a problem for many markets, hospitals, hotels, canteens and similar undertakings, and this appliance should in many cases give the complete answer. It is a compact piece of equipment and needs no expert or constant attention. If the furnace capacity of 11 cubic feet is insufficient for any particular purpose then of course two or more units can be installed.



*The Mayor of Scunthorpe, Alderman F. J. Brown, J.P., at the inauguration of the new Hoskinson Incinerator*

The B.100 will be shown and demonstrated at the Society's Clean Air Exhibition at Harrogate in October next.

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**VISIT THE N.S.C.A.**

**STAND — A.14**

**Royal Society of Health**

**Exhibition, Scarborough,**

April 9th to 13th

Publications and selection of display materials will be shown

# *The Dispersion of Air Pollution*

by

**R. S. Scorer, M.A., Ph.D.**

*The Dawes Memorial Lecture to the Annual Conference of the Association of Public Health Inspectors, 1961, reprinted from "The Sanitarian". The author is Reader in Applied Mathematics, Imperial College*

IN this age when most people spend a large part of their time using or operating machines whose workings they do not understand, reading about the achievements of engineering and science, believing that a man will, without any doubt, land on the moon within a decade or so, they are inclined to the view that any problem is susceptible of solution if enough effort is put to it. This includes theoretical problems too, since it is widely believed that with the high-speed computing machines of the present or near future any desired calculation can be done. The question is therefore legitimately asked: "In what way can all these theoretical and technological advances help with the problem of air pollution?"

It is obvious that the solution of the problem rests primarily in the prevention of emission. But since our economy depends on the making of pollution, I shall, as a meteorologist, attempt to answer the question: "Can science say anything helpful about the processes of dispersion which will help in the solution of our problem?"

The Beaver Committee expressed the view, and it was widely supported by many eminent people who ought to know better, that more observational data about air pollution was required and more research was necessary before the problem could be solved. It has been national policy since then to encourage local authorities to make as detailed routine observations of smoke and sulphur dioxide as they can be persuaded to embark upon. Now these observations are desirable not as part of a necessary programme of research, although without doubt much so-called research will be done upon the data that is being collected, but simply to convince each community that their town is as dirty as the others. We have grown so used to filthy air that councillors are not always ready to believe that an effort to get cleaner air in their town is necessary or even important.

Not long ago, I sat before a group of people of whom some were from Bangor in North Wales. Knowing of my interest in air pollution, a well-known public figure remarked, "There's no air pollution problem in Bangor!" Shortly afterwards the D.S.I.R. report showed that Bangor could at times be severely polluted and the press saw fit to mention Bangor by name in commenting on the report because it was apparently a surprise to them. The moral, of course, is that a small area can get seriously polluted in the middle—while for the same reasons even a small smokeless zone can be very much improved in the middle, even if surrounded by smoky areas.

We need to arouse a visual consciousness of air pollution. I can remember Sir Roger Duncalf, the Deputy Chairman of the Beaver Committee, saying how, after working with the Committee for a few months, he began to see all the air pollution around him which had previously escaped his notice. He had created the problem of air pollution for himself, and everyone should be encouraged to do the same.

Figure 1 illustrates Exeter, figure 2, Lincoln, not, one might have thought dirty cities, and certainly not as they are seen in picture postcards. But in



Fig. 1



Fig. 2

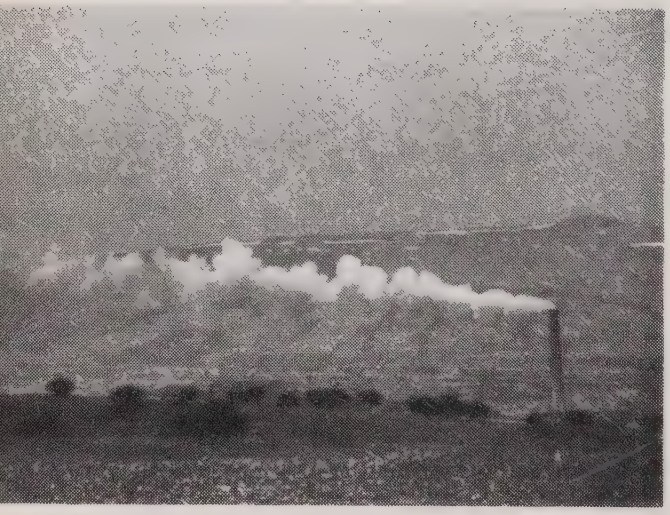


Fig. 3



Fig. 4

this modern age, only instrumental readings are regarded as true. The evidence of our eyes and noses, the experiences of housewives, the filthy buildings—these are ignored, while the evidence of a " scientific " measurement will be accepted. Yet one only has to look at the great variations in the values measured by the instruments to see that we would be no less wise if they only had an accuracy of 50 per cent.

Once the order of magnitude and range of variability of pollution in a district are known, nothing new of value can be learned from instrumental readings. However interesting, more extensive, detailed, or long term surveys may be to the collector of statistics, they are of no value in helping with abatement.

I am talking, of course, about instruments measuring pollution out of doors. I am, for the moment only concerned with the pollution after it has been emitted into the air. I am not criticising the use, for example, of instruments used to determine the composition and solid content of flue gases, which are a very great help towards the efficient use of fuel and the prevention of obnoxious emissions.

**New Chimneys**

If there is already a great deal of pollution, it is prudent to exercise some control over emissions from new plant. I therefore wish first to dwell for a moment on the problem of predicting what difference a new chimney will make to the pollution of a neighbourhood. Experts have been asked for " the formula " which gives this. It is common practice among engineers (as in other professions), when faced with a problem of this kind which is outside their special field, to search out in the literature a formula proposed by some known expert and to use it, asking as few questions as possible because the qualified answers which would be received would only make life more difficult. A simple formula is preferred to a dissertation on how the air disperses the pollution put into it.

People want to be told simple answers, and not subjected to long lectures about the adiabatic lapse rate, the definition of a mean value, gaussian distributions, inversions, etc. I propose to discuss, in as simple a manner as the subject permits, the complicated nature of the atmosphere why it is not sensible to give " the formula " and what we should do about it.

In the most respectable theories of dispersion of gases from a chimney the air is presumed to be turbulent. There are however several ways in which it can be turbulent and figures 3 (a Derbyshire Cement works) 4 (a Nottinghamshire colliery) 5 (a power station), and 6 (a maternity hospital) show how a chimney plume can be thin and straight, twisted with a large scale sinuosity, carried aloft by its buoyancy, or fragmented by a small scale gusting of the wind. When reminded that the " turbulence " can be of these various kinds (and several others as well) the theoreticians will have a parameter or two available in their formulae to be adjusted to suit the kind of turbulence that may prevail. This is most unsatisfactory because the formulae presume only to give the magnitude of the pollution averaged over a sufficiently long time. Usually conditions change so that the parameters have to be changed before the time has been sufficiently long!

As if this were not complicated enough the air may sometimes not be turbulent at all and completely new formulae have to be devised for such occasions. The air becomes stably-stratified and instead of being spread gradually into a greater and greater volume of air the smoke is carried away as a trail, often not widening for several miles. Figure 7 shows the smoke from the power station at Ironbridge, ceasing to mix after reaching a certain height in a stably-stratified atmosphere. Such plumes have been observed extending, without spreading, for many miles on some occasions. Figure 8 shows the same power station on a day when the eddies were so strong that the dusty plume was brought down to the



Fig. 5



Fig. 6

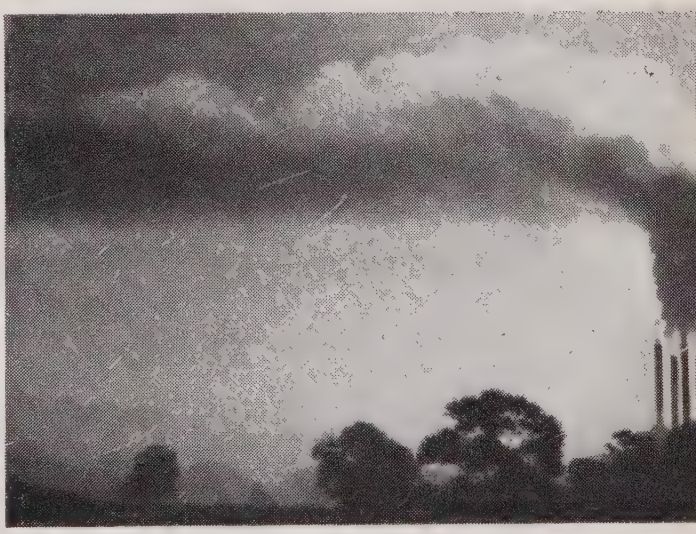


Fig. 7

Fig. 8



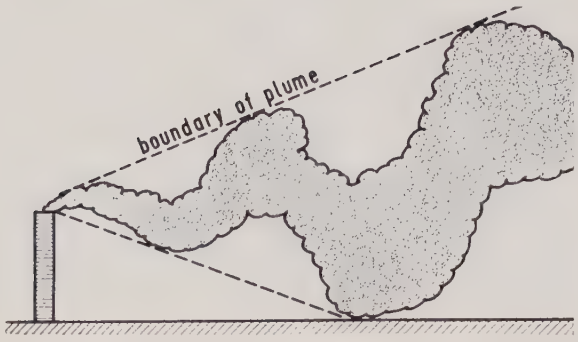



Fig. 9

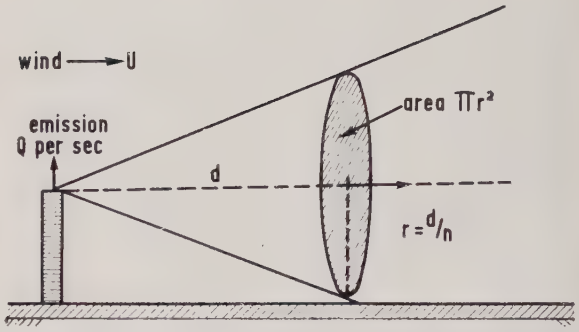



Fig. 10

*Figs. 9 and 10. The latter shows how the average pollution from a plume such as illustrated in Fig. 9 can be computed with a fair degree of approximation. The pollution, P, over shaded area is given by* $Q = \pi r^2 UP$. *The number n must be estimated from observations, and is usually between about 8 and 20*

ground quite close to the station, but of course only intermittently.

Before leaving these turbulence theory formulae, it is useful to get them in perspective. Most pollution in this country undergoes little chemical change in the first few minutes after emission. We know that it has got to go somewhere, and we can see with our eyes more or less where it goes to when the smoke is very dense. The simplest and crudest of calculations tells us approximately what the average concentration will be at any point, if we assume it to spread out more or less in the way we observe as indicated in figure 9. The sophisticated formulae proposed by different authors differ from one another as much as they do from a simple calculation based on this concept, and the observed concentrations differ more from one hour to the next, from day, month, year, or decade to the next than the predictions of the different formulae differ from one another. The sophisticated formulae are therefore of no more use than the crudest of reasonable calculations, and I do not think there has been any instance in the history of civil air pollution where the crudest calculation would not have served as well as the complicated one. The complicated formulae, being incomprehensible to all but a few, are more respectable, and therefore more often employed. But they are pure mumbo-jumbo, indeed I would say that they were misleading, because they leave the user quite helpless when they go wrong. In figure 10 I have illustrated the kind of simple calculation that can give as good an answer, and it is easily intelligible.

## No Single Formula

It is clear, therefore, that the atmosphere has several patterns of behaviour which cannot be treated by one single formula. We have to plan either for a random succession of these weather types and make some estimate of the effect averaged over a long time, or we have to examine the various weather types and decide which of them are likely to produce serious pollution problems. Although we know that these problem types usually occur in winter, not all winters have the same number of problem days, and we are led to wonder whether the weather forecasters can give any useful warning of conditions like those illustrated in figure 1 for example. The answer is that they can. If we were as anxious as some spokesmen profess to be to rid ourselves of the blight of air pollution we would ask for warnings to be given by the forecaster every time the atmosphere threatened to stop dispersing pollution adequately. Severe restrictions could then be put on the kind of pollution that could be legally emitted. For example, householders wou d be permitted to use only smokeless fuels; certain industrial processes emitting fumes through low chimneys would be compelled to cease operation; steam trains would have to

run on coke in towns; the emission of visible exhaust would be an offence in law which was more effectively dealt with than now; and so on.

All this could be done now, and could have been done ten or twenty years ago. It depends in no way on the results of research or the laborious making of measurements, still less on sophisticated formulae. We know now how to make the kind of weather forecast required, and we know now how to stop making a great deal of the pollution with comparatively little expense. After a winter or two of this kind of serious endeavour to avoid the damage by air pollution smokeless fuel, high chimneys, and efficient running of engines would become normal. We do not do this because we do not want it enough: we do not want it because we are, as a people, not sufficiently aware of the benefits of clean air, and of how dirty our air is.

Even so, if only because some of the measures are expensive, it would still be necessary to decide what restrictions should be imposed at time of ineffective natural dispersion of pollution. Priorities would have to be agreed. We have to ask whether it is more important to deal with the householder, the small industry, or mammoth industries like electricity generation, or with railways, foundries, or chemical and steel works. And where in the scale are road traffic and central heating plants?

The two most important features of the atmosphere are its stratification and the wind strength. A strong wind removes the pollution and dilutes it into a greater volume of air than a light wind. If the wind were always moderate or strong the present output of pollution would do a small amount of damage compared with what is actually suffered now. A light wind is less effective and is often, though not always, less turbulent. The occasions of light wind are the ones that concern us, and as a good first approximation we can forget about all other occasions.

**Determining Priorities**

I shall now examine how the behaviour of the atmosphere determines the priorities. In summer, light winds can be very turbulent because convection currents generated by the sunshine spread the pollution upwards, (figure 11), and the stratification is often such that the heat generated with the pollution serves to carry the pollution upwards artifically. If we can partially solve the pollution problem in the winter it will, as a by-product, be solved almost completely in the summer. We should concentrate our attention therefore on about 60 winter days and nights when the wind is light and the stratification so stable that vertical dispersion is inhibited. Figure 7 illustrates such stable stratification at a high level, Figure 12 at a low level.



Fig 11.

The power station plume in figure 7 is not carried upwards, but neither, when the stratification is stable, is it carried downwards, so that immediately it only pollutes any neighbouring hillsides which may reach up to that level, and it does not pollute the valley air. I do not propose to go



Fig. 12



Fig. 13

into the details of how these stable layers of air are formed. It is sufficient to note that they are more common in valleys, at night, in winter, and are more intense and frequent low down. By low down I mean below a few tens of feet above the house tops. The consequence of this fact about the atmosphere is that tall chimneys extending 150 ft. or more above the general skyline and which reach, on many occasions, above many of these stable layers contribute far less to the pollution at the ground than low level chimneys. In this country height is the most important of all the factors which control how much the pollution emitted will foul the air close to the ground in which almost all human activity takes place.

There are places, such as Los Angeles, where all the pollution is trapped below a rather high stable layer which is well above all chimneys and is impenetrable even to the hottest and tallest sources of pollution. Because some air remains over the Los Angeles area, often for a few days at a time, the convection currents generated over the sun-warmed ground serve not only to dilute the vehicle exhaust upwards but also to mix downwards clouds of smoke which had at first risen well away from the ground. But we do not normally experience such a situation in Britain in cloudless skies.

These stable layers I have been talking about are often referred to as " inversions." Clearly there are several kinds of inversion—high, low, intense, feeble—and more than one may sometimes be present at the same time, the air being very stable close to the ground and below the tops of the tallest chimneys, and only slightly stable above that, so that hot buoyant power station plumes are not trapped but are carried away by such wind as may exist aloft when the air is calm below.

Many of our towns are situated in shallow valleys, and it is a property of the atmosphere that the air within valleys becomes more readily stratified, and stays so, than air over plains, or air above mountain tops. Smoke often accumulates below the mountain tops in the valleys of the Alps. It is impossible to build chimneys of metallurgical works to carry the pollution out of these deep valleys. Figure 13 shows the same phenomena in a Derbyshire valley where a cement works has filled the valley with dust. This was taken before the tall chimney shown in figure 3 was built. With shallow valleys it is possible to build chimneys up to the level of the surrounding hills, and then the effluent is emitted into the air above the stagnant mass in the valley. Figure 14 shows the effluent from a power station chimney, and the warm air from its cooling tower, emerging out of a badly polluted valley in Lancashire.

## Other Factors

Mention should be made of some of the other factors which determine the harmfulness of pollution. The most important are:

(1) the chemical nature of the pollution. Smoke from inefficient fires and furnaces is much worse than from efficient ones and the gases and dusts from certain industrial processes (*e.g.* brickmaking, foundries, and steelworks) are much worse than from the straightforward combustion of fuel in a power station.

(2) whether the pollution is emitted clear of building tops or not. If not it can be carried down the sides almost undiluted. This is illustrated in figure 15.

(3) how near to people and property the emission takes place (for example, trains and power stations in the country do less harm than in towns.).

(4) whether the emission is concentrated into periods when it can do most damage. (Most industrial pollution takes place outside the 60 problem days of the year mentioned earlier on, but these are days on which people tend rather specially to stoke up their fires at home.)

(5) some area sources of smoke and dust tend to increase the stability of the air by the reflection of sunshine from the particles and the loss of heat by radiation from them. Thus, large, dense housing estates have a bad effect on the stratification of the air if their chimneys are smoky.

We thus see that the atmosphere treats the emissions from different sources of pollution in different ways. This can be illustrated by comparing two extremes—a typical urban household and a large modern power station. An old-fashioned fire, frequently lit up from cold, produces smoke and noxious gases which make the effluent about seven times as damaging as the sulphur dioxide and

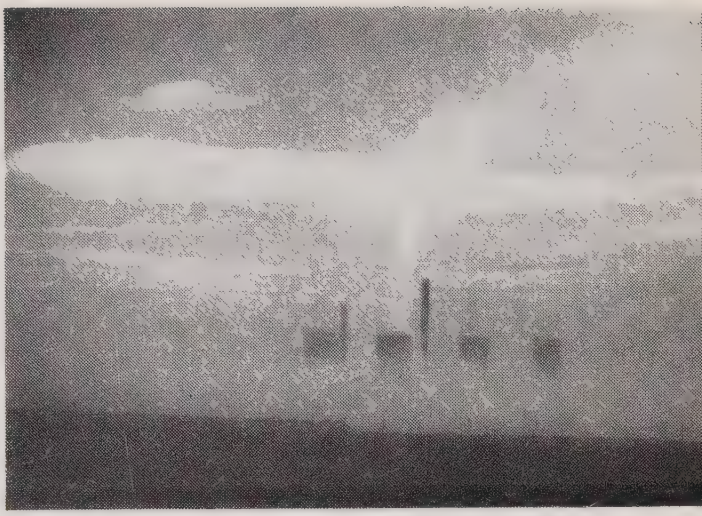


Fig. 14



Fig. 15

fine dust from the power station. The height of the power station chimney and the large amount of heat (and buoyancy) mean that the dilution of such effluent as reaches the ground, and the smaller proportion of the total that does so, render the power station effluent about 300 times less potent than the effluent from the same amount of coal burnt in a typical house. The household effluent is put out predominantly in cold, damp, stable weather, while the modern base load power station operates more or less continuously: on this account, therefore, the household effluent is about four times as damaging.

Finally, most houses are close to places where damage can be done by the effluent and tend to be in large

estates (*i.e.* in large area sources), and are about three times as damaging as the power stations which tend to be more remote from concentrations of population.

All these factors must be multiplied together to obtain the final figure of about 25,000 to 1 for the ratio of the damage done by the effluent produced by burning one ton of coal in a typical household grate on the one hand and in a modern base load power station on the other.

One can apply a similar argument to other types of source. Clearly these figures are only rough and the answer could be in error by a factor of 10 or even 50 quite easily; indeed, an accuracy better than a factor of 10 is scarcely to be expected because this is the order of magnitude by which the damage varies from town to town and from year to year. The interesting thing is that even so the ratio between these extremes is very large, perhaps as low as 500, perhaps as large as a million. The proportion of the total damage done by power station effluent is therefore very small, and that done by household smoke appallingly large, and the latter is probably at least as great as the cost of the coal burnt. This conclusion is reached by finding the ratios for all the major types of pollution sources, and dividing among them the total damage experienced in the whole country, say, £500 million a year.

Thus, a ton of bituminous coal burnt at home does about £10 worth of damage. The use of smokeless fuel would at least halve this damage and is well worth the extra cost of the fuel. Electric heating is, from the community's point of view, much more economical than heating by burning any sort of fuel at home, unless that fuel produces *only* $CO_2$ and $H_2O$, and no $SO_2$, unburnt hydrocarbons, or oxides of nitrogen.

A word should be interpolated here about using oil heating. If a sulphurous fuel is used the $SO_2$ will sometimes be much greater in amount than from solid fuels, and although not properly covered by the present law can do great damage. Architects seem to ignore this point almost completely, and I have recently seen a new school where the sulphurous fumes are rapidly killing a once beautiful chestnut tree, which, I suspect, was being used by the architect to "hide" the chimney. Architects do try to hide chimneys, not use them to dispose properly of the noxious effluent.

Steam trains and road traffic, in towns, also show up very badly in this kind of calculation.

We thus begin to obtain our priorities. Low level multitude emissions, inefficient combustion, and emission within centres of population are our enemy, and must be the first to be prohibited at times when the Meteorological Office forecasts weather in which the emissions will not be well dispersed. We may also remark that to spend 10s. (the approximate actual cost) washing the effluent from a ton of coal burnt in a power station, as is done at Battersea, is a shocking waste of effort because at best it saves only a few pence. Indeed, this kind of gas washing should only be *permitted* at times of smog.

The conclusions concerning the overwhelming contribution of houses to the total damage by air pollution in this country do not imply that there are not some local problems of a special kind—like brickworks, steelworks, foundries or even certain power stations. But while the germs in our throats are being killed by the whiff of $SO_2$ from the tall efficient chimney on a breezy day, let us not forget the smoke and fumes that hang over our homes—they are the real problem according to this meteorological analysis.

**Summing Up**

I believe that this basic problem will not be solved until the average citizen becomes as conscious as Sir Roger Duncalf of it. To sum up, therefore, we may state the following conclusions concerning the dispersion of air pollution:

(i) Detailed measurements of air

pollution are not necessary once the order of magnitude and the range of variability have been discovered. Further records add no useful knowledge.

(ii) An appreciation of the presence of the problem by the average citizen, and more particularly by councillors, is very necessary before real progress can be made. They must be taught to see around them every day the pollution that is omnipresent.

(iii) Our efforts should be designed to eliminate first the sources which
  (*a*) are at a low level
  (*b*) are at a low temperature
  (*c*) contain obnoxious smoke (unburnt fuel) and other harmful constituents
  (*d*) are close to people and property which may suffer damage
  (*e*) make their emissions predominantly at times when the low level air becomes stagnant (household chimneys satisfy all these conditions!).

(iv) It is most important to first eliminate these emissions at times when the weather is such that the pollution is not well dispersed, *i.e.* particularly at night, in light winds, in valleys, in winter.

(v) Forecasts of the imminence of these adverse conditions can be given by the Meteorological Office, and enormous amounts of damage could be prevented if our efforts were concentrated upon stopping the worse emissions at these times.

(vi) Since great benefit is to be obtained even if only a small locality is made smokeless, voluntary efforts by groups of householders can be very beneficial.

(vii) Architects must be made to treat the problem of chimneys as seriously as they treat the problems of roofs and windows, and not hide them. They should base their siting of the points of emission of pollution on the perfectly well understood and well known aerodynamic principles which they have almost completely ignored hitherto.

This analysis is not new, but not until today have I had the opportunity to describe it to the people who really matter, to you, who are the intermediaries between the people on the one hand, and the scientists and law makers on the other, and without whom our efforts would be without effect. I am very much aware that in applying these principles there are human difficulties which you have to face, but I would not presume to tell you how to overcome them: they do not lie within my special province. I value highly my contacts with you for they make me aware of the true nature of these problems, and I am indeed grateful for the invitation to deliver this lecture.

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5. Colour 35 mm. filmstrips produced by Diana Wyllie Ltd., 3 Park Road, Baker Street, N.W.1. Air Pollution: B. Dispersion and Accumulation of Air Pollution: Behaviour and appearance of Smoke. Stable Weather: Inversions, their causes and effects.

# AIR POLLUTION IN ROAD TUNNELS

A report of a study on this problem, by R. E. Waller, B. T. Commins, and P. J. Lawther, of the Medical Research Council Air Pollution Research Unit, was published in the *British Journal of Industrial Medicine* (1961, 18, 25) and has now been issued as a reprint in pamphlet form by the British Medical Association (pp. 10).

The authors' summary is as follows.

As part of a study of pollution of the air by motor vehicles, measurements have been made in two London road tunnels of high traffic density. The concentrations of smoke and polycyclic hydrocarbons found there are much higher than the average values in Central London, but they are of the same order of magnitude as those occurring during temperature inversions on winter evenings when smoke from coal fires accumulates at a low level.

An attempt has been made to relate the concentration of each pollutant to the type and amount of traffic. Both diesel and petrol vehicles make some contribution to the amounts of smoke and polycyclic hydrocarbons found in the tunnels, but in the case of smoke, fluoranthene, 1:2 benzpyrene, pyrene, and 3:4 benzpyrene, the concentrations appear to be more closely related to the density of diesel traffic than to that of petrol traffic. The concentrations of lead and carbon monoxide have also been determined, and these are very closely related to the density of petrol traffic. During the morning and evening rush hours the mean concentration of carbon monoxide was just over 100 ppm and peak values up to 500 ppm were recorded at times. Oxides of nitrogen were determined in some of the experiments and there was always much more nitric oxide than nitrogen dioxide. Eye irritation was experienced but its cause was not investigated.

The concentration of pollution in the tunnels does not appear to be high enough to create any special hazards for short-term exposures. The atmosphere at peak periods may become very dirty and unpleasant and the concentration of carbon monoxide would be sufficient to produce some effect over a period of several hours' continuous exposure. The total emission of pollution from road vehicles must still be small in comparison with that from coal fires, but the effect of traffic on the concentrations of smoke, polycyclic hydrocarbons, carbon monoxide, and lead in the air of city streets deserves continued study.

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# NEWS FROM THE DIVISIONS

*Scottish Conference and Exhibition*—A conference under the auspices of the Scottish Division of the Society and the Royal Sanitary Institute of Scotland was held at Grangemouth on January 13. The principal speaker was Dr. A. G. Mearn, senior lecturer at Glasgow University. A civic reception was given to the delegates.

There was also a three-day clean air exhibition, organized by the Society, in the Grangemouth Town Hall, which was open to the public. In addition to the Society's exhibits there were displays by the electricity, gas, and solid smokeless fuel authorities. A new note for such an exhibition was the inclusion of a fashion display.

*North-West*—The Division held its annual general meeting on February 8, at, and prior to an inspection of, the Bold Colliery of the National Coal Board at Collins Green, near Newton-le-Willows, Lancashire.

# NORWICH CONFERENCE ON CLEAN AIR

*Report by P. F. Brooks*

" Since the passing of the Clean Air Act in 1956 industrialists have become more conscious of their obligations as a result of publicity given to the subject during recent years, and they now deplore the sight of the once common smoke plume from the factory chimney because it means inefficient, and consequently uneconomic, use of fuel."

This opinion was put forward by Mr. J. H. Smellie, Chief Public Health Inspector, City of Norwich, at a well attended Conference on " The Clean Air Act," and organized by the East Anglian Regional Advisory Council for Further Education in conjunction with N.I.F.E.S.

Mr. Smellie went on to say, " By modernizing its furnaces and thus economizing on fuel, industry has some financial interest in supporting a clean air policy. A wealth of advice and practical help is available through various existing bodies to secure the most efficient and economical use of fuel, heat and power, yet ultimately it will be the effective enforcement of the Clean Air Act which will accelerate the rate at which modernization proceeds."

Although the primary duty of local authorities was to enforce the Act, Mr. Smellie could not help feeling that more and more they were acting in an advisory capacity.

After reviewing the history of air pollution in this country he referred to the Beaver Committee and said that their estimate of 40,000 existing hand-fired boilers still in use showed that there had been little material modification or replacement of fuel and power equipment since the first world war. This preponderance of old hand-fired plant was recognized in the Act, which accepted that it cannot be operated smokelessly and laid down standards of density and duration of permitted emissions of dark smoke. Mr. Smellie thought that we ought no longer to tolerate the old hit and miss method of hand firing and remarked, " The employment of the odd job man or labourer on firing, with lack of interest both by employee and management in smoke emission or fuel costs can not be allowed to continue. The change to mechanical firing is the only way in which out dated plant can be made to operate smokelessly."

He referred to the lack of any definition regarding furnaces in the Act for the purposes of Sections 3 and 6 and said that in most industrial boilers being internally fired the furnace is the combustion chamber, and in practice a new furnace would not be installed unless with a new boiler or with the renewal of the furnace tube of the existing boiler. Having regard to the longevity of many existing shell type boilers it would not seem that the requirements of Sections 3 and 6 would apply " during our lifetime " to existing installations.

**Chimney Heights**

Mr. Smellie said that Town Planning was concerned with how low chimneys could be built in order to preserve the sky line, whereas public health was concerned with how high they should be in order to protect health. This issue had to be considered not only in relation to emissions but also to the prevailing level of pollution in the area from aggregate sources, and added, " We cannot ignore the potency of concentrations, or deposits present at ground level."

The second speaker was Mr. E. J. Tickner, Area Engineer of N.I.F.E.S., who dealt with the industrial requirements of the Act.

He referred to work carried out by N.I.F.E.S. in about 30 cases in East Anglia and said that investigations had shown that practically all were of smoke and smut emission, complaints of grit emission being relatively few. One third of the cases had been due to

bad operation and another one third due to bad conditions of the plant itself or conditions imposed on it by overloading, underloading or by sudden peak demands. The remaining third had arisen from a combination of these faults and aggravated by the fuel in use, with only two or three being entirely due to the use of unsuitable fuel.

Mr. Tickner seconded Mr Smellie's remarks on hand firing, saying, " Hand firing cannot usually be justified nowadays as there are numerous types of mechanical stokers and automatic boilers available." He stressed the importance of intelligent operation of all plant and said that all operators should receive adequate training. At the present time a Bill is being prepared which, if adopted, will require this.

Mr. Tickner pointed out that it was a fallacy to assume that flues serving oil fired plant did not need cleaning, and he pointed out that a regular inspection of these could provide an indication of efficiency of operation.

He dealt in detail with plant maintenance and defects and reminded his audience that something like twenty times as much air is required for combustion as the weight of fuel burnt, this calling for ample permanent air inlets to the boiler house and not merely adventitious openings. A smell of fumes was often an indication of this deficiency.

Like Mr. Smellie he was concerned about chimney heights, saying that Section 10 had led to much difficulty. Under the Act a much higher chimney is likely to be required than would otherwise be proposed. The height required is purely arbitrary, although some authorities had adopted varying standards.

Mr. Tickner said that to avoid down wash a minimum velocity of exit from chimneys of 20 to 25 feet per second had been suggested, based on the maximum rating of the boiler plant or else the height of the chimney should be increased by five to 10 feet.

For tall office buildings the $2\frac{1}{2}$ times rule could be impracticable and a height of at least 10 feet above the ridge had been suggested.

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**Southport's Smoke**

Industrial smoke in Southport has been almost entirely eliminated, writes the Medical Officer of Health, Dr. G. N. Wishart, in his annual report. It follows that domestic chimneys must be supplying nearly all the smoke in the atmosphere.



*Members of the East Midlands Division during a visit to the works of the Staveley Iron and Steel Co. Ltd.*

# *Training for Diesel Efficiency*

The Society's policy on the diesel smoke problem is the promotion of the efficiency of combustion by good operation and maintenance. Most of the troubles that occur in the diesel vehicle engine are due to too much fuel being injected, insufficient compression in the cylinders, and faults in the injector and its nozzle giving faulty atomization.

For complete combustion the fuel pump must be working accurately, feeding the correct amount of fuel to the injector, which in turn must be clean and working accurately. When smoke emission is occurring (and fuel is being wasted through this and in other ways) the trained fitter is normally able to put things right easily and quickly. That is, when he has located the trouble and knows what is causing it.

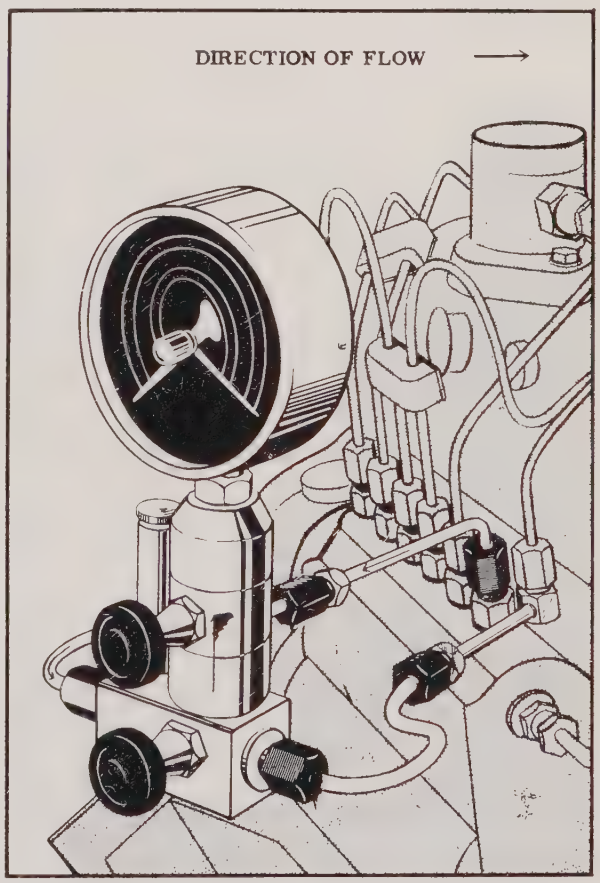
Diagnosis can be difficult and time-consuming unless the fitter is properly trained for the job and has suitable instruments with which to do it. A visit was made recently to the training school in Clapham organized by one of the Society's members, the Dunedin Engineering Co. Ltd., where regular short courses are held for diesel maintenance engineers and fitters.

Dunedin are well known for the precision instruments they manufacture by which the required diagnosis can be made in a very short time and without dismantling the engine. The tests are in fact made on the engine while it is running under ordinary working conditions. The " Injectester " is, in brief, a gauge in which a pointer moves over a calibrated dial and which is connected by its own pipes into the fuel pipe lines of the engine by the simple removal of one nut at a time, as will be seen from the diagram. The engine is started in the normal way and under actual running conditions each unit of the injection system can be tested, first on the pump end and then on the injector end of each supply line. Readings are made of pressure and of pressure drop when the engine is decelerated or stopped. The time for a given pressure drop is, for instance, an important factor. If necessary each injector is removed to observe if the spray pattern is correct.

A further instrument, the " Diestester " is used to test the compression in the cylinders, again under actual working conditions, recording the compression at the correct temperature and at any engine speed.

**The Dunedin Smokemeter**

At the training school there are diesel engines fitted with the instruments and ready for detailed testing, together with models and sections of injectors and all other aids to learning the job thoroughly. Smoke density tests can also be made, using the Bosch type of smokemeter which the Dunedin company is manufacturing




*Injectester Connected at the Pump End*

under licence, with modifications, in this country. This is itself worthy of attention. There are available a sampling pump with its accessories, all contained in a steel carrying case, together with an evaluating instrument. The sampling pump exhausts a sample of exhaust gas via a sampling probe that is inserted into the exhaust pipe and which aspirates it through a filter paper which retains the soot content.

The evaluating instrument is a battery operated micro-ammeter in a steel box with a photo-electric cell pick-up on a cable. The pick-up is placed on the darkened filter paper disc. The light source of the pick-up throws a beam on to the disc and the unabsorbed light is then reflected from the darkened filter paper on to the photo-electric cell. The current thus generated corresponds to the degree of darkening on the filter paper and is indicated on the 0 to 10 scale of the micro-ammeter.

If correct fuel supply is a key factor, so also is adequate air supply in this as in all other smoke and combustion problems. (It would sometimes be useful to think of the oxygen as the fuel.) The importance of this is well illustrated in a case we heard about at the school. There had been many complaints about smoke from one particular vehicle in a diesel fleet, but test after test in the garage had failed to reveal any fault. At last the driver was instructed that next time he found himself in trouble with smoke he was to halt and phone back to the garage. This soon happened and an engineer went off to investigate. Again no fault could be found with the engine. Then a look was taken at the air intake and filter, which was located in the driving cab, and was found to be carefully covered with the driver's cap. The driver explained that he always did that because it was then so much quieter!

To sum up our impressions, it was felt that here at Clapham a first-class and important contribution was being made to the prevention of diesel smoke on a technically sound basis.

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# AIR POLLUTION ABSTRACTS

**578. Retention of Aerosol Particles in the Respiratory Tract. A Review.** Mitchell, R. I. (Amer. Rev., Respirat. Diseases, Nov. 1960, **82,** 627-39). There is considerable disagreement among the various investigators as to particle retention in the lungs. The two major causes of lack of agreement are failure to use a uniform breathing rate and the use of a mean particle size to describe a test aerosol which has a wide size distribution. Both experimental and theoretical results show a minimum retention in a 0·4–0·6$\mu$ range. All of the data also indicated 90 per cent. or more retention of particles greater than 7$\mu$. In addition to particle size, the next greatest variable affecting retention is breathing rate. The theoretical calculations of Landsahl agree well with the experimental results obtained by his co-workers, except for particles in the 2$\mu$ range. For this size, the theoretical calculations give results that are too high at both breathing rates studied. The use of radioactive NaCl to obtain an approximation of alveolar retention gives an excellent means of measurement for retention in the smaller branches, bronchioles, and alveoli in therapeutic applications of aerosols. To establish definitely the particle size for maximal retention, the experiments should be repeated using a non-hygroscopic carrier. The results of glycerol-water aerosols indicate that the maximum occurs for particles which have an equivalent diameter of 1·5$\mu$. By assuming that the particles grow until they contain 85 per cent. water, the diameter for the maximum would increase only to 2·3$\mu$ (Author's Abstract) (APCA).

**579. Atmospheric Pollution.** (In French). Besson, M. and Florentin, D. (Bull. Acad. Natl. Med. Paris, 1960, **144,**

15-16, 292-5). With the increase of industrial activity and of transportation, and with the increase and concentration of population, the degree of air pollution has risen drastically. In a section of Paris, including the Madeleine, L'Opéra, and the circle halfway down the Champs Elysées, the amount of carbon monoxide in air at the height of approximately one metre has doubled between the years 1957 and 1958. The average content at the latter period was 31 ppm. with occasional peaks of over 100 ppm. at certain locations. The blood content of CO was compared in two groups of persons: drivers of automobiles and persons who did not drive cars on a regular daily basis. Of the latter group, 45 per cent. had a blood content below 0·4 per cent. In 1958 only 7·79 per cent. of the persons in the first group were below this figure; 60 per cent. were above the level of 1 per cent. which is considered dangerous; and 14 per cent. were above 2 per cent. The contents of various substances in the air, total acid and smokes (in g./m.$^3$ averaged for 24 hours), are being measured daily by the Hygienic Laboratory at 12 stations in Paris. Instantaneous measurements of $CO_2$ and CO are also being measured by the Laboratory. The combined pollution from domestic and industrial origins on certain days in February 1959 averaged 0·7 ppm. of sulphur anhydride for 24 hours. There was some correlation between these conditions, during a period of unfavourable meteorological conditions, and the increase in mortality. Under such unfavourable conditions the increase of $SO_2$ in the air can become a definite health menace. In the area of Saint Denis the presence of benzopyrenes and other polycyclic hydrocarbons occurred in the air. In another industrial area, $H_2S$ and sulphur gas pose a problem. Any plan to decentralize Paris is more theoretical than real but some thought could be given to the location of industry in certain areas, and the use of non-sulphurous fuels and of diesel motors. (Author's Abstract) (APCA).

**580. Woods as a Natural Barrier against Air Pollution in Areas of Concentrated Industrialization and Urbanization.** (In German). Weisser, D. (Wasser Luft u. Betrieb, March 1961, Wiesbaden **5**, 96-8). Woods and parks have an exceptional position in the control of contamination of the air. The filtering effect of foliage and needles reduces dust and detoxicates the air of the industrial waste gases by causing turbulence and deviation of the air-flow. The air in a wooded area is a decisive factor in the oxygencarbon dioxide cycle which is indispensable for the welfare of man, animal, and plans. Such a wooded area feeds a continuing stream of fresh air, with a high percentage of oxygen, into the air dome pressing upon the concentrated areas of industrialization and urbanization. On the other hand, the woods themselves are subject to the influence of noxious emissions from industrial areas. Conifers have been found to be more susceptible to toxic emissions than are deciduous trees. Therefore, there has been a trend for some time to change to the deciduous types in those trees making up such a wooded barrier. (Author's Abstract) (APCA).

**581. Dust Problems in Large Cities.** (In German). Wildfuhr, G. (Z. ges. Hyg. Grenzg. Berlin, Sept.-Dec. 1958, **4**, 241-8). This is a general review of the pollution which, in large cities, derives principally from industry, transport, and domestic heating. The first two sources are increasing alarmingly. $SO_2$ and $H_2SO_4$ arise from the sulphur content of coal, gas, and diesel oil. Industrial sources emit ammonia, chloride, HCl, $H_2NO_3$, and HF acid. All of the latter are irritants and respiratory poisons. Carbon monoxide, produced by imperfect combustion, has a toxic limit between 0·01 and 0·02 per cent. by volume. Since unlike $SO_2$ it is lighter than air, it is rapidly diluted but concentrations up to 0·04 per cent. have been recorded in heavy traffic. Dust and smoke particles are most harmful to man when about 1$\mu$ in size. Carcinogenic dusts include compounds of arsenic, beryllium, chromium and nickel. Chimney smoke contains carcinogens. The spread of pollution is conditioned by micro-climatological and meteorological factors; vertical and horizontal spread are equally important. The pollution from traffic is significant mainly at street level; domestic fires have an appreciable effect to a height of 20 m.; and industrial pollution to 50 m. The heaviest burdens of pollution are found at low wind speeds and high relative humidities. Warm air masses carry more dust than cold; the source and the route over the continent determine the dust-load of a travelling air mass. Woods and parklands exert a filtering effect which is enhanced by warmth and moisture. Town planners should bear the following points in mind. Green areas are needed for purification.

Railroads and industry should be placed at sites away from residential areas and separated from them by belts of greenery. Individual buildings should be so placed as to allow free circulation of air around them. Main traffic routes should be located leeward of a city. A table in the text gives the occurrence of the spores of seven species of Clostridium collected by sampling plates over the city of Leipzig. (APCA).

**582. Measurement of Exhaust-Smoke Density from Diesel-Engined Vehicles.** Savage, J. D. (Jour. Inst. Road Transp. Engrs., June 1961, **14** (4), 183-213). It is predicted that current official interest in the density of exhaust smoke from diesel-engined vehicles could lead to the adoption of more stringent controls in certain countries. Established instruments for measuring the density of diesel engine exhaust smoke are described, and their various advantages and disadvantages are discussed. The use of these instruments for quick " on-the-road " and " standing " tests is considered and compared with their use in engine test shops and research laboratories. Reference is made to various simple measuring techniques currently being investigated by fleet owners, vehicle manufacturers, etc. The use of smoke-meters for diagnosing causes of excessive exhaust smoke is also mentioned, and smoke-density limits suggested by various bodies are reviewed.

**583. Smokeless Charging.** Meades, M. R., and Randell, G. E. C. (Gas World, Coking, June 1961, **153,** 55-60, 62-63). After discussing alternative methods, the authors concentrate on " on the main " charging and on the smoke evolved during " dropping " and levelling. Tests carried out at the Avenue coking plant concerning the steam jet at the top of the ascension pipe indicate that the " front " position of the jet is preferable. Smokelessness was improved by employing a higher suction and by charging in series. To facilitate this, a modified charging car was constructed incorporating individual lid removal and replacement by mechanical means, and larger hoppers on the outside than in the centre. Methods of adapting sequential charging to batteries with single collecting mains are suggested.

**584. Automatic Boiler Control for a Hospital Boiler Plant.** Anon. (Steam Engr. July 1961, **30** (356), 349-351). Automatic boiler control was installed at the General Hospital of the Birmingham United Hospital group primarily to reduce smoke emission, but it has had the effect of raising boiler efficiency by 3·45 per cent. in spite of a change to a lower grade of fuel. The installation consists of four Super-Economic boilers fired by low-ram coking stokers. Some operating results are given. The financial saving in six months represents one-third of the cost of the equipment.

**585. Report on Measurements of Smoke Emission from Industrial Boilers. 2. Coal-Fired Shell Boilers with Various Types of Mechanical Stokers.** (British Standards Institution, 1961, BS 2978, Part 2, London, the Institution). Results of tests performed on representative plants are reported with a view to establishing the extent to which smoke can be reduced by good practice, and the means of securing such reductions, states the conclusions drawn from these results and summarizes the factors influencing smokeless combustion in shell-type boilers with mechanical stokers.

**586. The Variation of Atmospheric Sulphur Dioxide Concentration with Altitude.** Braun, R. C., and Wilson, J. G. (Int. J. Air Wat. Poll. 1961, **5,** 1-13). A light-weight air sampler carried on a small captive kite-balloon has been used to determine atmospheric sulphur dioxide concentrations at heights up to 500 ft. Measurements were made at two sites, one built-up and the other open, in the London area. Concentrations up to 116 p.p.h.m. were observed. On one day the concentration at 500 ft. was very nearly the same as that at 100 ft. (roof level), whereas on a clear night the concentration at 500 ft. was only $\frac{1}{3}$ to $\frac{3}{4}$ of that at 100 ft. On another occasion a high concentration was found at 250-350 ft. Measurements in three fogs showed that the concentration at 500 ft. did not differ greatly from that on the ground or at 100 ft.

**587. The Determination of Fluorine in Deposit-gauge Samples.** Jeffery, P.G., and Williams, D. (The Analyst, September 1961, **86,** 590-597). The reaction between fluorine, cerium and alizarin complexone described by Belcher, Leonard and West, is used for determining fluorine in samples from deposit gauges. Prior separation from interfering elements is achieved by means of a column of cation-exchange resin and also by distillation from perchloric acid solution. The results obtained by these two methods agree well with

those found by a method involving distillation from perchloric acid and subsequent titration with thorium nitrate solution (alizarin red S as indicator).

**588. On the Nature of the Synergistic Action of Aerosols.** Goetz, A. (Int. J. Air Wat. Poll., Sept. 1961, **4**, 168-84). This paper gives a theoretical treatment of the kinetic aspects of free gas molecules and their interaction with the surface of airborne particles. It aims at a physical interpretation of aerosol synergism in general, and in particular of the intensification of toxic (or irritant) gas traces by certain aerosol types. Aerosols can act as intensifiers of the physiological reaction if their substance has a sorptive affinity for the toxic gas component large enough to produce an accumulation on the particle surface, but smaller than the affinity of the tissue surface which they contact in order to effect a transfer of the molecules thereon. If the particle affinity substantially exceeds that of the tissue, an attenuation of the effect should occur. Within the margin of experimental error the data can be described quite accurately by the theoretical functions and no conflict is apparent. (Author's abst. cond.).

**589. Atmospheric Pollution from Power Station Stack Emissions.** (In Roumanian). Burducea, C. and Curelaru, A. (*Energetica*, Sept. 1961, **9**, 339-350). The paper discusses means of combating atmospheric pollution from $SO_2$ and fly ash from power station stacks and factors affecting the pollution. Consideration is given to the amount of noxious matter discharged from a stack and factors affecting it, permissible amounts of $SO_2$ discharge in different countries, and calculation of the propagation of noxious matter in stack effluents. (CEGB).

**590. A Study of Polycyclic Hydrocarbons and Trace Elements in Smoke in Merseyside and other Northern Localities.** Stocks, P., Commins, B. T., and Aubrey, K. V. (Int. J. Air. Wat. Poll., 1961, **4**, 141-153). (1) Smoke samples collected continuously for one or more years by filters in Merseyside conurbation and elsewhere in northern England and Wales were analysed for 7 polycyclic hydrocarbons and 13 trace elements. The locations included seaside and riverside, small and large towns, a smokeless zone, the Mersey Tunnel, bus and motor car garages, an office and a steelworks. (2) The amount of coronene in smoke varied little in town or country but the higher levels in tunnel smoke and in the motor garage were such as to suggest its usefulness for measurement of air pollution by motor traffic. (3) In country places amounts of smoke and of the hydrocarbons were $2\frac{1}{2}$ times as great in the autumn-winter half of the year as in the spring-summer half, but in Merseyside, whilst the seasonal ratio for total smoke was similar, for the hydrocarbons it was about 5 to 1. Indoor office air was less polluted than that outside in winter, the hydrocarbons showing a seasonal ratio about 4 to 1. (4) Trace element concentrations in air were all higher in urban than in country places, but only for antimony, vanadium and molybdenum was the excess relatively greater than for total ash. Mersey tunnel air contained very much greater amounts of lead than did the entering air, and in a motor garage the air contained more lead and vanadium than the air outside. In the smokeless zone trace elements were present in smaller amount than at the town centre. In the rolling-mill shed and melting-shop of the steelworks, concentrations of all the elements, particularly of copper, were largely increased.

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**Humidifier and Air Purifier**

The new thermoplastic H-R humidifier and air purifier has been developed to meet the ever increasing demand for an inexpensive yet efficient substitute to central air conditioning systems in centrally heated buildings. It has been designed to counteract the ill effects of excessive dryness. Its capacity is sufficient for enclosed rooms up to approx. 1,800 cu. ft.

Depending on the temperature and relative humidity of the room air, it will evaporate from one to four pints daily. Since the rate of evaporation is higher in very dry conditions and lower when the humidity level in the room is higher—the action of the humidifier will be automatically adjusted to the prevailing conditions.

The H-R units are equipped with special filter-evaporating elements which have been subjected to a special treatment to render them perfectly hygienic and chemically clean. The filters attract and absorb dust, dirt and fumes from the radiators, and the hot air is in this way washed and cleansed of dirt before being passed into the room.

# CONTRIBUTIONS TO CLEANER AIR

## TECHNICAL AND INDUSTRIAL PROGRESS

### Smoke Density Indicator

Photoelectronics (M.O.M.) Holdings Ltd., Sutton, Surrey, have produced a Photoelectronic Smoke Alarm and Smoke Density Indicator equipment. These units are claimed to be effective in enabling industry to comply with the Clean Air Act requirements and to assist in ensuring more efficient combustion.

The Smoke Alarm has been designed to fill the need for a low cost unit which will enable industry to comply with the Clean Air Act. It can be fitted to any type of flue or chimney and will give immediate visual and audible warning of excess smoking. In practice, a light beam projector unit throws a beam of light across the chimney on to a photo-electric cell, housed in a receiver unit. The photo-cell converts the light into electrical energy and as smoke breaks the light beam, a varying current is emitted by the cell. This current operates a relay and when the smoke has reduced the current emitted by the cell to a point set by the operator, the relay operates and the alarm is given.

The Photoelectronic Smoke Density Indicator operates on the same principles but, in addition, incorporates a 10-inch meter, calibrated in percentage obscuration on which the density of smoke is indicated at all times. An alarm relay is incorporated to give visual and audible warning when smoke exceeds a pre-set level.

### Packaged Smokeless Fuel

The N.E. Gas Board are now marketing their premium grade smokeless fuel, "Cleanglow," in 28 lb. bags through local retail shops, Co-operative stores and gas showrooms in the West Riding of Yorkshire.

### All-Gas Central Heating for Bradford Flats

Bradford Corporation claims to be the first local authority in the area of the N.E. Gas Board to decide on all-gas heating service for their new two, five-storey blocks of flats and maisonettes at Hillside Road, Bradford.

The buildings have been erected by George Wimpey & Co. Ltd., and the heat services provided by gas-fired equipment include warm air heating, instantaneous hot water, warm air clothes drying cupboard, home laundry and cooking.

The warm air heating unit, water heater and drying cupboard are all "room sealed," *i.e.* the air for combustion is taken from a central duct and the products of combustion are exhausted into the same duct.

The heating of the flat or maisonette is by warm air provided by a Sugg Halcyon F/60 type heater. Heat is provided to the living room, hall and kitchen in each case. In the maisonette, sufficient warm air is supplied by the hall register to give a reasonable temperature rise to bedrooms and bathroom by natural convection means.

The fan of the Halcyon heater draws air from the living room and hall through the grilles fitted at high level and then, through a filter to remove dust. The fan then pushes the air through the heat exchanger where its temperature is increased before it is returned to the rooms through the warm air registers. Normal ventilation is not interfered with by the heating arrangements.

Control of the heating systems is by either of two air thermostats. The one in the living room is set to give comfort conditions and the one in the hall is set to give only background heating conditions.

### N.C.B. to use Gas-Propelled Locomotive

A special eight-cylinder gas engine has been developed by Rolls-Royce engineers and installed in a 230 h.p. shunting locomotive for the National Coal Board. The locomotive is capable of hauling a 1,000-ton train and runs on methane gas drawn off from coal seams. It is believed to be the first locomotive in the world to run on methane.

### Smokeless Fuel Plant Extension

A contract valued at approximately £200,000 has been awarded to W. J. Jenkins & Co. Ltd., a member of the Woodall-Duckham Group of Companies —by Coalite & Chemical Products Ltd.

The contract is for the handling plant and steelwork required for the extension which will augment the production of the premium smokeless fuel, "Coalite," at their Askern works, near Doncaster.

### Wall-Mounted Convector/Radiant Heater

The prototype of a new wall-mounting convector/radiant heater for the 1962-63 heating season was featured on the stand of Ekco Heating & Electrical Ltd., at the recent Electrical Engineers Exhibition.

Designed for locations where combined radiant and convection heating is required, the new Ekco Thermovent Type WMRC heater occupies no floor space and projects only $5\frac{3}{4}$ in. from the wall or partition on which it is mounted. A high-efficiency, thermostatically-operated $1\frac{1}{2}$ kW. convection unit and a 1 kW. silica-sheathed radiant element are controlled by a four-position double-pole rotary switch, providing a choice of independent convection or radiant heat, combined convection and radiant heat and an " off " position.

### Waiting for the Train in Comfort

St. Helen's new Shaw Street Station, recently opened by Sir Harry Pilkington, is centrally heated throughout by means of gas. A gas-fired 200,000 B.Th.U. Potterton boiler has been installed to heat the station buildings and a gas-fanned warm air heater has been fitted in the adjoining taxi office.

Heat-resistant glass has been fitted in the high central hall to prevent overheating in hot weather.

### Heating a Sectional Building by Electricity

An interesting installation of Ekco Thermovent wall-mounted convectors and Ekco Thermotube tubular heaters has recently been completed in the new Civil Defence Headquarters at Bexleyheath, Kent. A sectional pre-fabricated building, the headquarters has a total floor area of 2,232 sq. ft.

The total loading of the heating installation is 26 kW. and it was planned by the Ekco Heating Advisory Service (41-47 Old Street, London, E.C.1) and installed by the London Electricity Board. The building was supplied by J. Thorn and Sons Ltd.

### Fume Precipitation for New Kaldo Converters

A complete plant for the collection and disposal of iron oxide fume from the two new 45/55-ton Kaldo Converters at Shelton Iron & Steel Limited's new melting shop has been ordered from Simon-Carves Limited (whose Precipitator Division was merged with Lodge-Cottrell Limited at Birmingham some time ago). The contract has been placed by the Steel Processes Division of Davy and United Engineering Co. Ltd. As far as is practical, the operation of the plant will be completely automatic with that of the steelmaking operations.

The Kaldo Converter process of steelmaking in which a jet of oxygen is blown into a rapidly-rotating converter vessel, produces a fume containing some 80 per cent. of iron oxide, most of the particles being between three and 20 microns in size and having a concentration in the exhaust gas of between 7-12 grains/n.c.f. of gas.

Each converter at Shelton is expected to produce about 10 tons of dust per day and as the contract includes dust handling and pelletising equipment, not only will a pollution hazard be prevented but also a useful financial contribution will be made by the recovery value of the iron oxide. The fume-removal installation will begin at the point where the gases leave the water-cooled hood at the mouth of the converter, at a temperature around 1,000°C. Refractory lined ducting will convey the gases first into a spray-cooled spark box where they will be cooled to about 400°C., and thence to a spray-cooled cooling tower where the gas exit temperature will be in the region of 150°C.

The gases will then enter the electro-precipitator, still in a " dry " condition, where the bulk of the fume will be removed. Each converter will have its individual precipitator, designed to handle about 47,000 c.f.m. of gas at 150°C. Each precipitator will contain two treatment zones and each zone will be energized by a static selenium H.T. rectifier set. The guaranteed efficiency of the plant under design conditions is 99·58 per cent., giving a dust outlet emission of 0·05 grain per n.c.f. of gas. For each unit a two-speed fan will convey the clean gas to a common chimney stack.

Drag-link conveyors will transfer the dry collected dust from the trough hoppers beneath the precipitators to the pan-type pelletisers.

### " Glo-Gas "

The S.W. Gas Board is to market bottled gas under the trade name " Glo-Gas." Special equipment has been imported from Sweden for this purpose. The gas is supplied in yellow-painted cylinders, bearing a blue and red " Glo-Gas " symbol, and these are fitted with a simple, fool-proof device to permit easy

and quick changing from one cylinder to another.

Each customer will receive two cylinders and one regulator, with tubing, on free hire and will only be charged 22s. 6d. on delivery for each cylinder full of gas.

**Incandescent Limited**

Incandescent Limited is the registered name of a new company which will take over the trading activities in the design, manufacture and installation of industrial furnaces and ancillary equipment from the Incandescent Heat Company Limited. In common with the other companies in the Incandescent Group, it will be a wholly-owned subsidiary of the Incandescent Heat Company Limited, whose merger with the Wellman Smith Owen Engineering Corporation took place last year. The date scheduled for the operation of the new company is April 2, 1962.

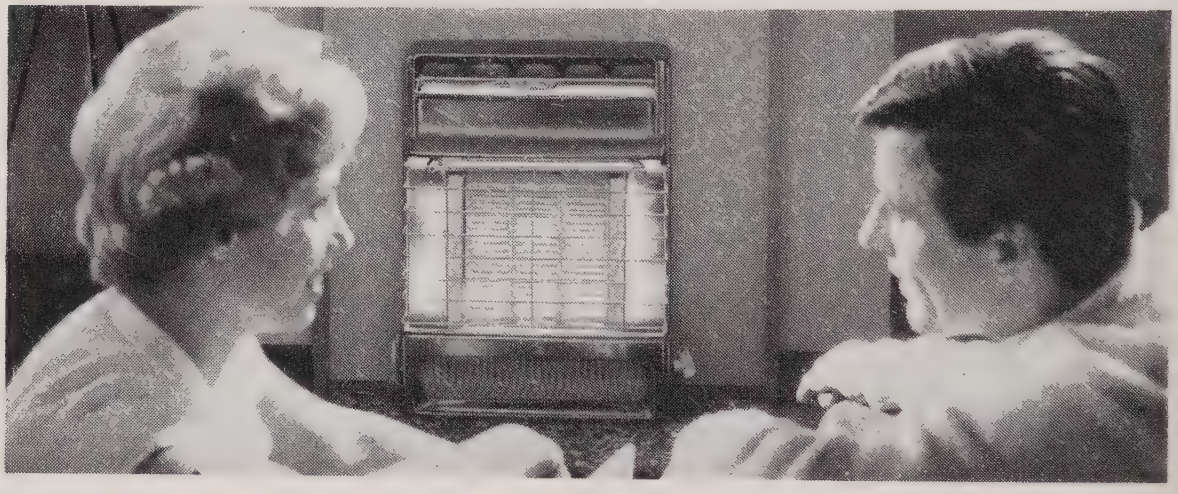
## NEW INDUSTRIAL LITERATURE

**Directory of Independent Consultants in Chemistry and Related Subjects**—Published by the Royal Institute of Chemistry, this fourth edition contains particulars of independent consulting practices in chemistry and has been designed to assist industrial firms, public bodies and other organisations and individuals to obtain consultant services, including analytical control of materials and operations and the investigation and development of new and improved materials and processes.

**Mesh Belt Conveyor Furnaces**—illustrated brochure by the Incandescent Heat Co. Ltd., Smethwick, on furnaces for continuous hardening and tempering.

"**Sunbrite**"—new information sheets covering a number of uses of Sunbrite hard coke, issued by the British Coking Industry Association.

"**Radiant Jet Furnaces**"—Leaflet No. V67 describing the recirculating Jetube radiant heating elements incorporated in these furnaces, produced by the Incandescent Heat Co. Ltd.

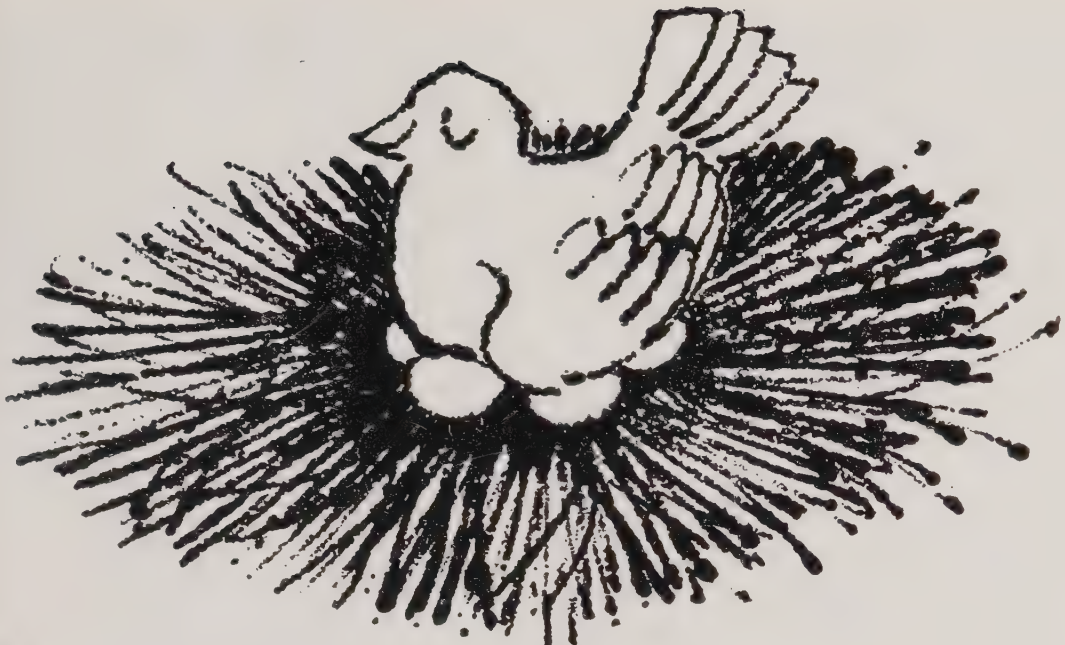


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In fact, electricity cuts out sweeping, and any other kind of dirty work. Electric floor warming, for instance, can provide warmth and comfort in any new building—office, factory or home—for a very moderate running cost. Also, it is cheap to install; electric floor warming obviates the need for fuel stores, chimneys, and (alas for an old and time-honoured profession!) the need for chimney sweeps.

Electric cleanliness is becoming more and more desired and desirable; where new housing is concerned, people choose electric cooking, because it keeps the kitchen clean and new looking. All round—electricity is the modern way. You just plug in and enjoy electric living.

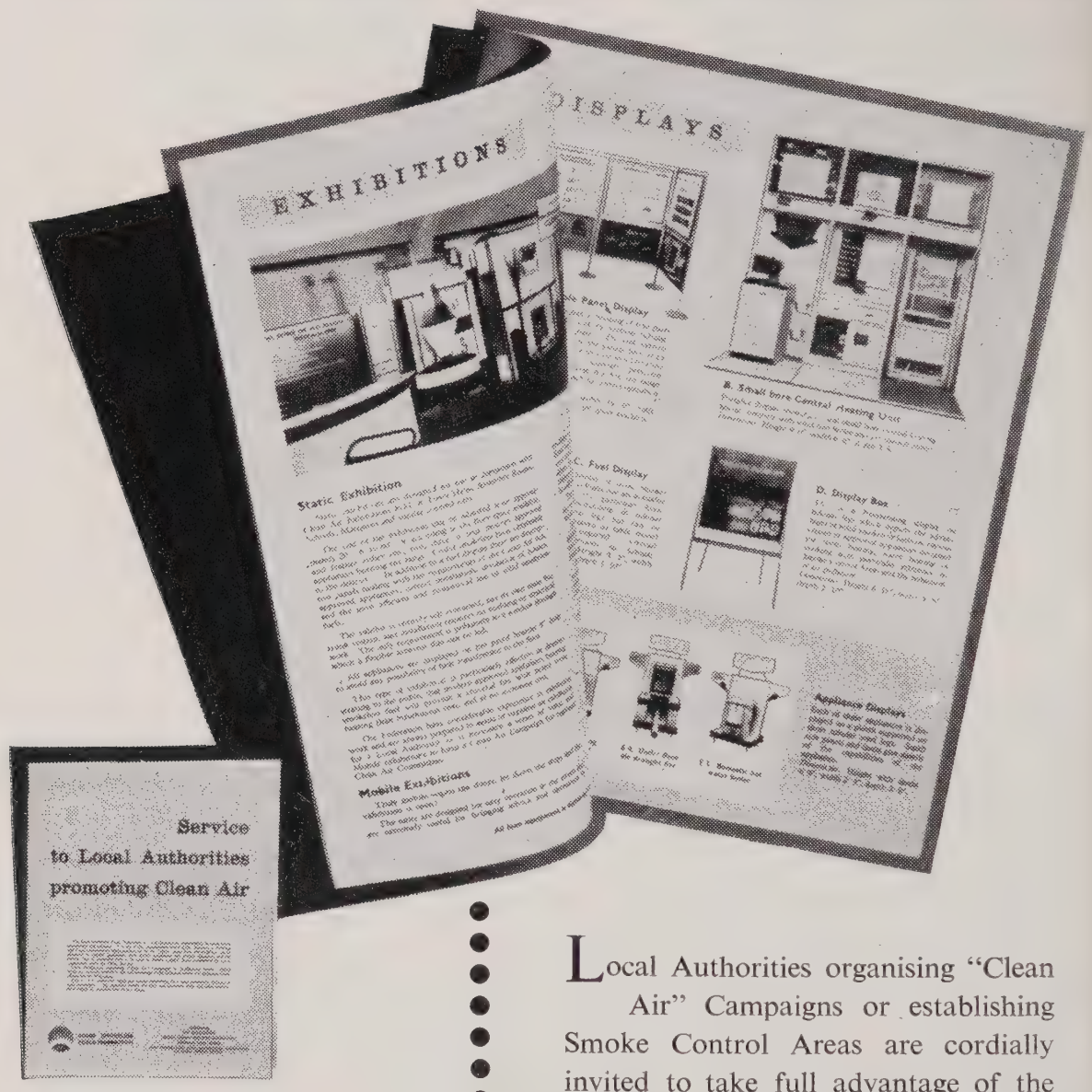
*There'll always be plenty of electricity.* Nuclear energy will see to that. Thank goodness. For electricity promises that we and our children will breathe clean and healthy air.

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## THE FUTURE IS ELECTRIC

# S.S.F.F. Service

## to Local Authorities promoting Clean Air




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describes and illustrates the services and exhibition material all of which are available free of any charge.

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Mobile and static exhibitions, fully manned by experienced demonstrators.

**DISPLAYS**
In a range of different sizes featuring appliances and fuels.

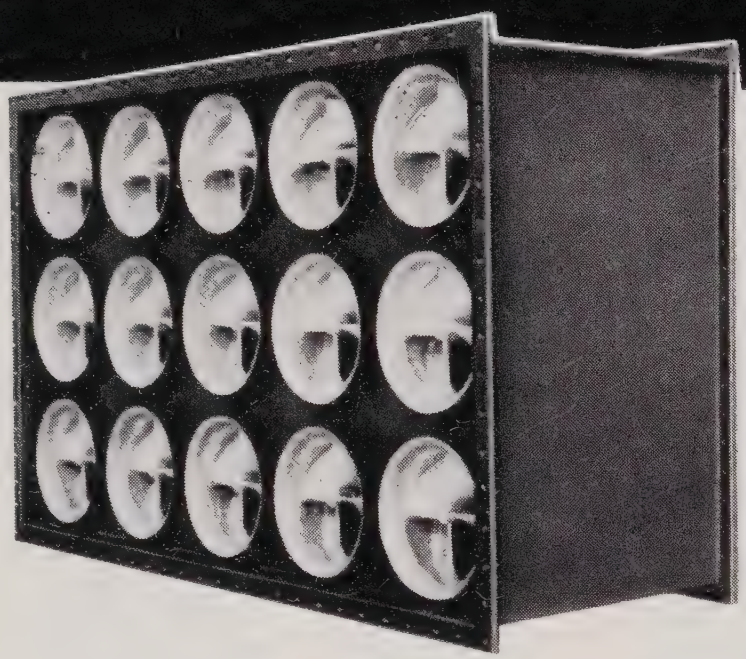
**LITERATURE**
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*Write for your copy to the*
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**74 Grosvenor Street, London, W.1** S.43

# SIROCCO
## "R" Type
# DUST COLLECTORS



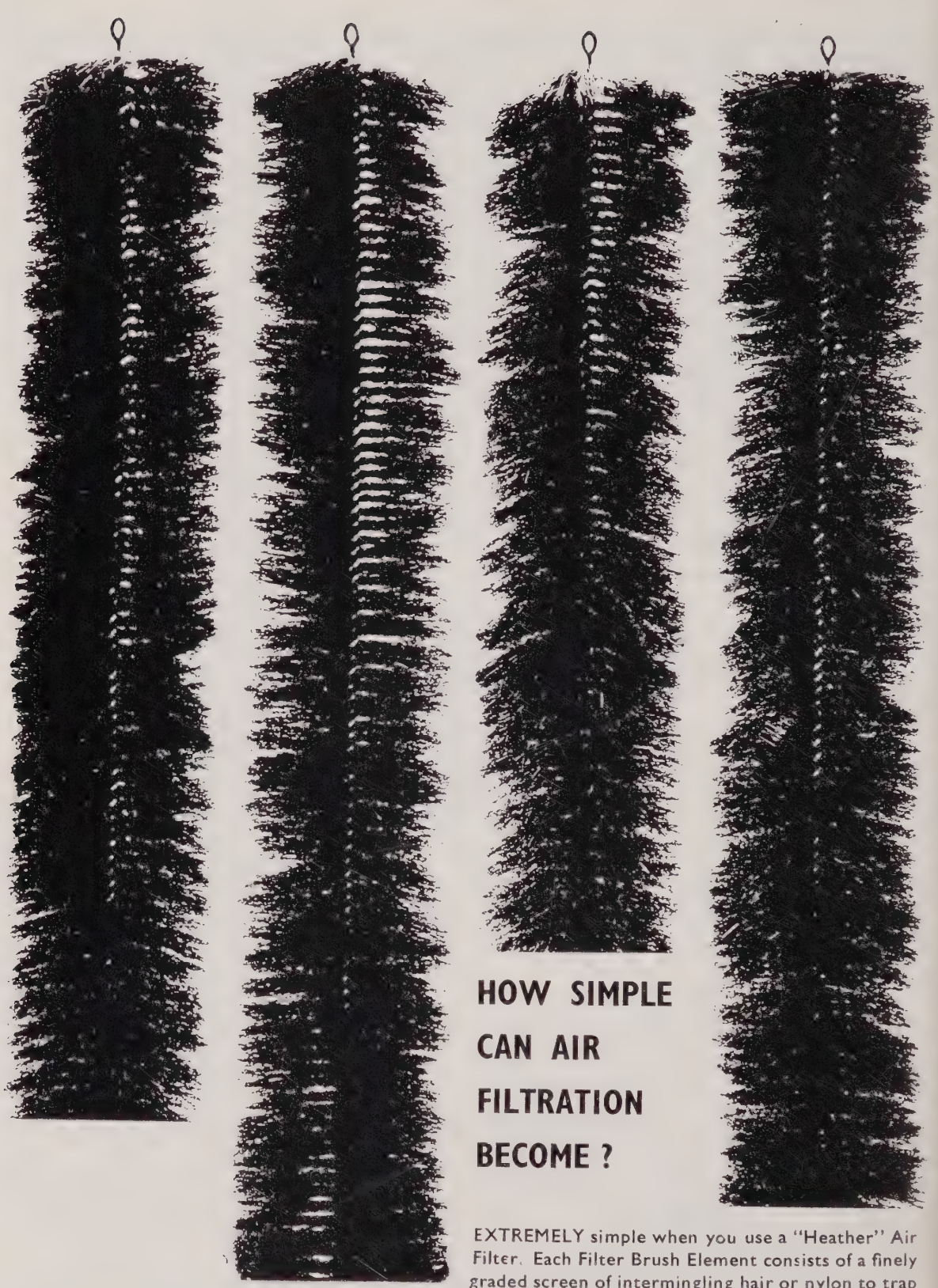
- Specially designed for use in the smaller industrial Boilerhouse.
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- Write to us for a leaflet giving full details of the Sirocco "R" Type dust collector.
- The resources of our Design, Experimental, and Testing Departments at Head Office, and the expert services of our various Branch Office Technical Staffs are available at all times to advise on the best and most economical approach to customers' individual requirements.

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7 Kendall Place, Baker Street, London, W.1. Telephone: HUNter 1801.

# ...but there is fire without smoke

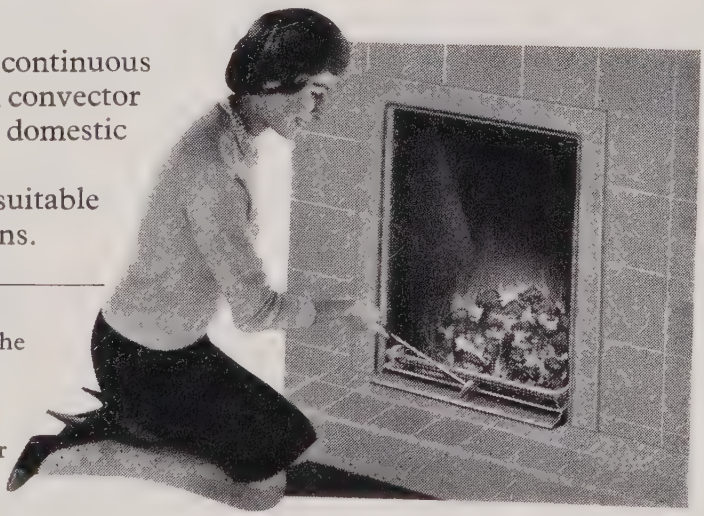
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The Baxi Patent Fire, the original under-floor draught fire, is officially approved for Smokeless Areas by the Domestic Appliances Council on behalf of the Minister of Power, and the Solid Smokeless Fuels Federation.

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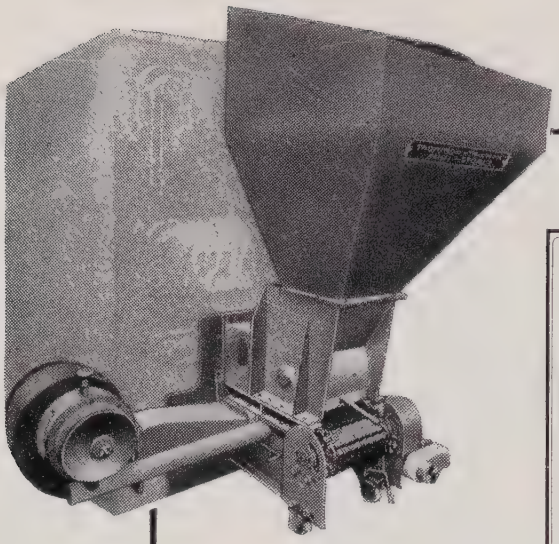
The under-floor draught of the Baxi Patent Fire enables you to make a bright and cheerful fire with coke. The fire will also, of course, burn any other type of smokeless fuel.

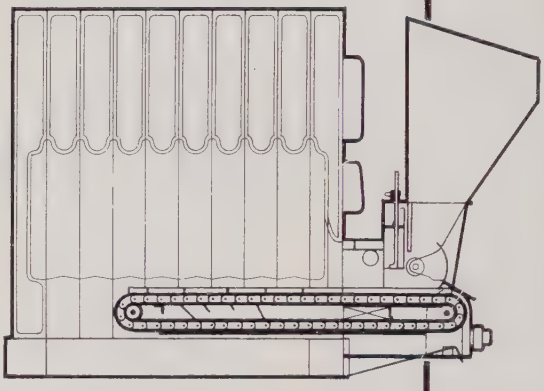


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*(Automatic too!)*

Meeting all the requirements of the Clean Air Act when burning bituminous coals, the Mini-stoker is especially designed for a wide range of sectional heating boilers, giving clean, smoke-free and highly efficient combustion with completely automatic action—robust in construction, simple in operation, easy to maintain. Essential in a smoke-control area, it will soon pay for itself and effect considerable savings by improved combustion efficiency and the use of low grade fuels. Semi or fully automatic control can be provided.

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*Automatic travelling grate*

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**"Gentlemen, please remember,**

**it is still your cheapest fuel—**

**safe, sure, certain, free from hazard—**



**. . . fire your**
**steam-raising plant with the**
**OLDBURY CHAIN GRATE STOKER**

and be assured in every circumstance of full boiler output and labour-saving, SMOKELESS combustion."

For nearly 20 years the Oldbury Stoker—the first successful chain grate for shell type boilers—has guaranteed efficient, SMOKELESS combustion in thousands of installations using the widest range of solid fuels. And, today the Oldbury Stoker has no peer.

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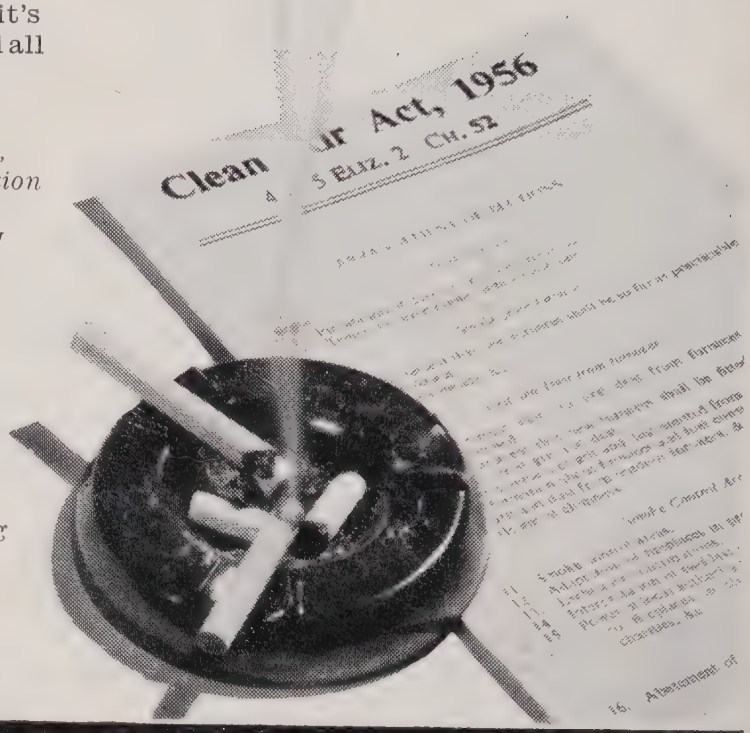
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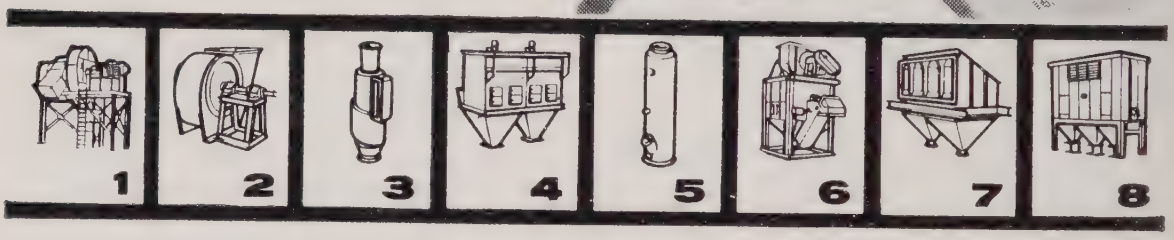
*"What do you mean—everyone's getting into the Act?"*

"I mean the Clean Air Act is here to stay. Every bit of combustion equipment manufactured and erected *now* must be designed to comply with the law—whether it's in a smokeless zone or not—and all existing equipment will need to comply by 1963."

*"I think it's a good thing because, apart from the atmospheric pollution it's making people think—about efficient combustion. That's why I say we should get in touch with Keith Blackman. They have a complete range . . . mechanical draught fans, dust collectors, combined induced draught and grit arresting fans . . . the answer to practically every problem inherent in the Act."*

"Well, they should know a thing or two. They've been at it for three quarters of a century — long before the Clean Air Act was even heard of."




*Please ask us for detailed descriptive literature on any item of equipment that interests you.*

**1** Induced Draught-Grit Arresting Fans
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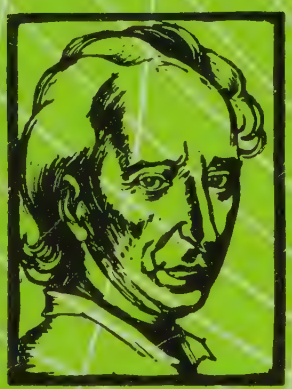
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JOURNAL OF THE
NATIONAL SOCIETY FOR CLEAN AIR



No. 122 * SUMMER 1962 * 2s. 6d.

*In this Issue*

Problems in Smoke Control Areas * New Clean Air Film * The N.C.B. Smokeless Fuel * Commons Debate on Diesel Smoke * New South Wales Conference, etc., etc.



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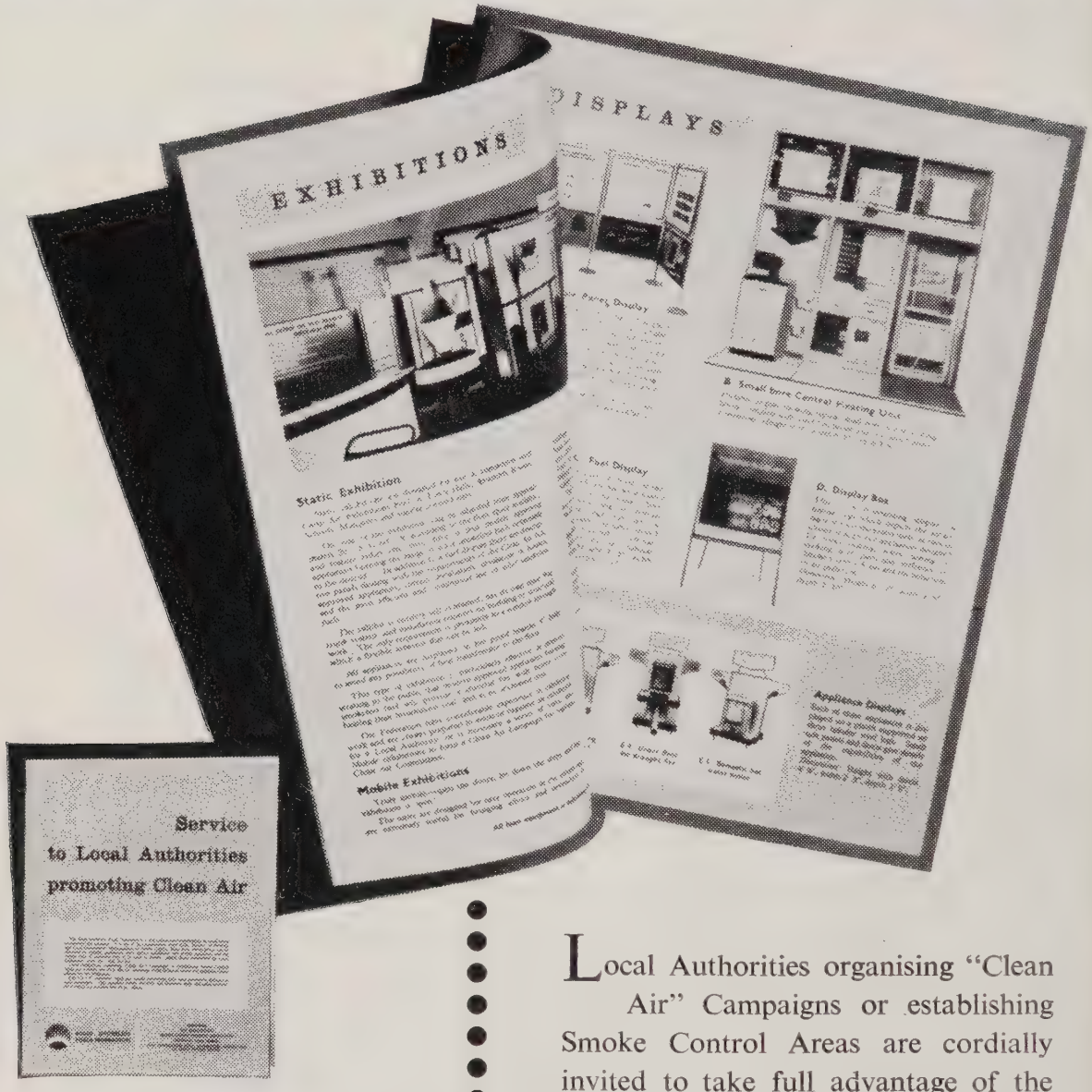
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**it is still your cheapest fuel—**

**safe, sure, certain, free from hazard—**



**. . . fire your**
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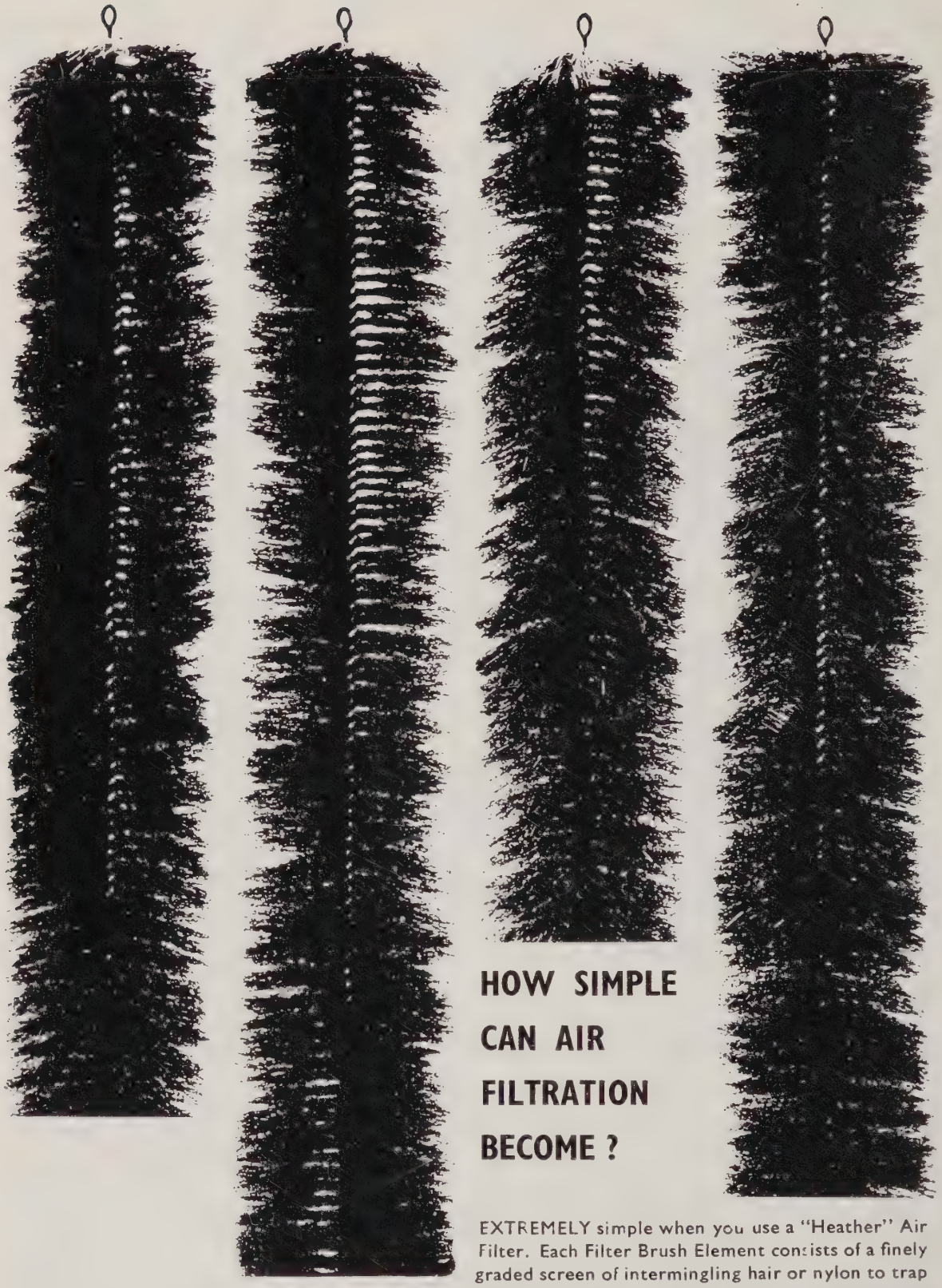
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**FUEL COMBUSTION PROBLEMS**
are mainly due to
**AIR STARVATION**
in Rooms and Flues




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Automatic HALL TO ROOM one way inlet at ceiling level
(As advised by the Coal Utilisation Council)

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**AIR STARVATION in ROOMS and FLUES**
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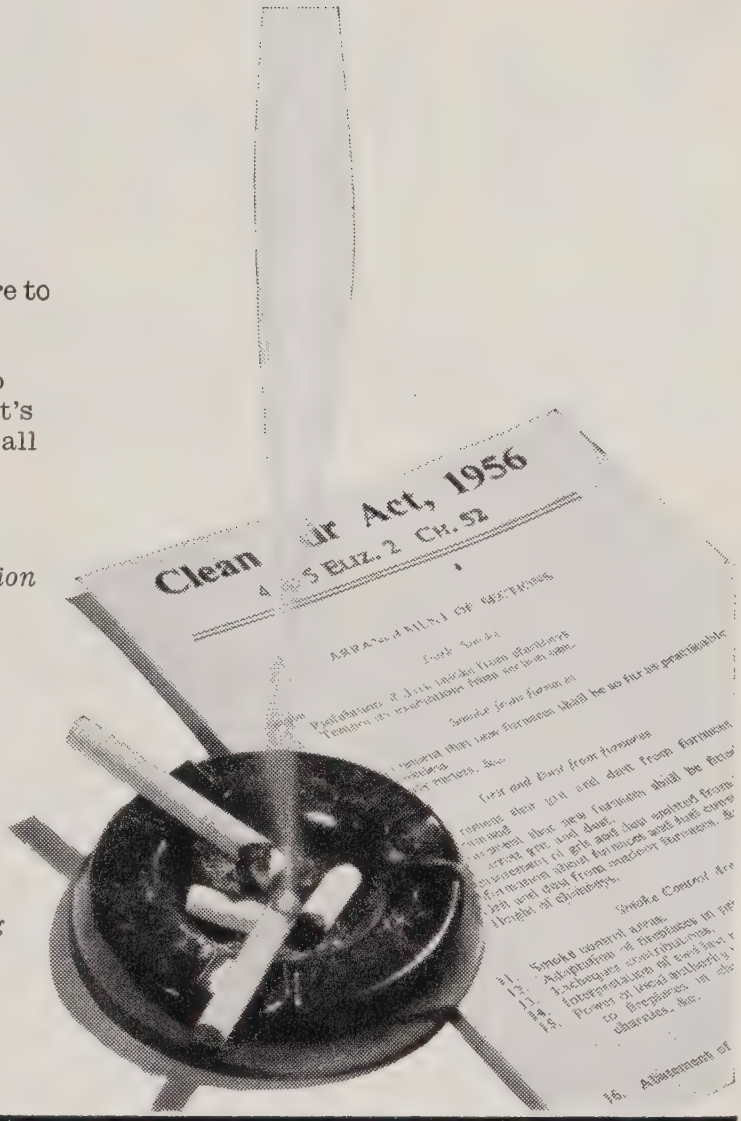
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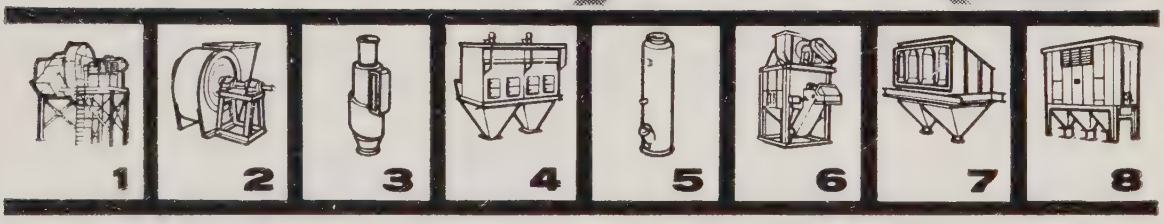
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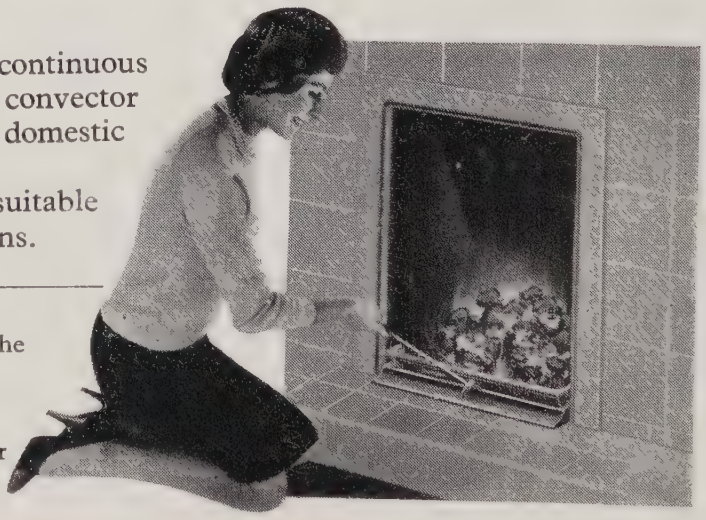
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# National Society for Clean Air

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NORTH-WEST: R. J. Stanyard, B.A.Admin., Health Dept., 16 Victoria St., Denton, Manchester (Denton 2302)

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*Reminder*

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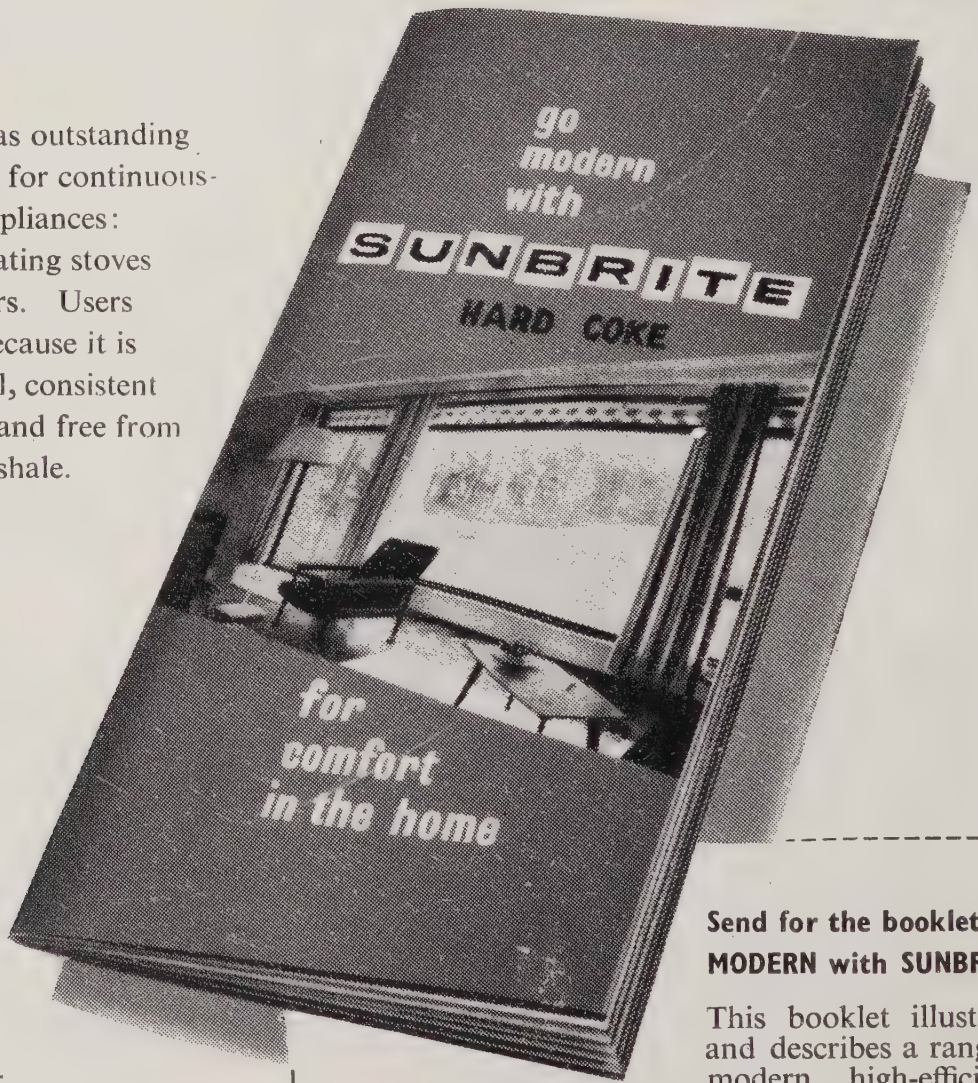
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# SMOKELESS AIR

Vol. XXXII No. 122 Summer 1962

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*Ships, towers, domes, theatres and temples lie*
*Open unto the fields, and to the sky;*
*All bright and glittering in the smokeless air.*

# SMOKELESS AIR

## LUNG CANCER

IT is sometimes suggested that a society for clean air should be actively concerned with the prevention of tobacco smoking or the contamination of the atmosphere by nuclear explosions. There may be something of a logical case for giving attention to both of these very different forms of air pollution, but there is a much stronger case for not doing so. This Society needs to concentrate its attention (and its limited resources) on the general pollution of the air, in accordance with the purposes that led to its formation.

Nevertheless, we cannot but be interested in the recent widely-publicized report of the Royal College of Physicians on "Smoking and Health". Firstly, because of its references to air pollution in general; secondly its brief comment on diesel vehicle pollution; and thirdly because of the effect of the publicity it has received.

The report discusses (pp. 23-24) the role of general air pollution and the evidence that suggests that this is a factor in the causation of lung cancer, together with evidence that does not seem to accord with this (*e.g.*, the high lung cancer death rate in Finland). No reference is made however to the most recent (and most important) report on the subject, by Dr. P. Stocks, in the *British Journal of Cancer* (September, 1960), which was reviewed in this journal (Spring, 1961) and from which a striking scatter diagram was prepared for reproduction in our Autumn, 1961, issue. Perhaps, however, this will be dealt with in the second R.C.P. report that it is stated will be published on air pollution, lung cancer and bronchitis.

The present report states: "Although general air pollution appears to increase the incidence of lung cancer, it is hard to see how its effects could account for the great increase in lung cancer deaths in the last three decades," but, on the other hand, "the fact that the disease does, rarely, occur in non-smokers and the effects of air pollution and various industrial hazards clearly indicate that other factors are concerned".

The problem is most complex and is almost wholly based on statistical information and its interpretation. It is of course not sufficient to take and examine the possible causative agents in isolation, for they may well react with or influence each other, or one may prepare the ground for another. But, from the statistical material available it must be accepted that cigarette smoking is the most important factor. Among the other factors (including, conceivably, some unknown) it is highly probable that the most serious is air pollution, and in particular the high hydrocarbon smoke from domestic fires.

If we may regard lung cancer as an epidemilogic or mass disease, then it is not out of place to quote from a searching analysis of disease and air pollution in which it was succinctly stated that "multiple causation of origin and course is a principle,

applying to all mass disease and mass injury. The direct agent of disease is but one feature of a disease-producing complex that lies within the environment."*

The point is stressed, not for the purpose of seeking in any way to minimize the importance of the tobacco factor, but simply to ensure that the attention, quite properly, being given to this does not detract from the air pollution aspects. The general public, and even many in positions of responsibility, are only too apt to simplify their thinking by accepting the notion of a single cause, whereas, and not least in the fields of health and social welfare, multiple causation is the rule and rarely the exception.

## *Vehicle Exhausts*

The belief is widespread that the rise in lung cancer is due to road vehicles, and particularly to diesel exhausts. The case for diesel smoke prevention would be assisted if this were so, but as there is no evidence to support it, the case is not helped by "believing". The R.C.P. report has a short paragraph on the point, in which it is quite definite:

"The possibility that motor vehicle exhausts might be an important cause of the recent increase in incidence of lung cancer can be rejected since there is no increase in lung cancer death rates among road haulage workers, who would be expected to have an excessive exposure to such exhaust gases."

Several Members of Parliament, speaking in the debate on Mr. Rupert Speir's Bill on diesel smoke, clearly hadn't read this in speaking on the menace to health. A medical member, Dr. Alan Glyn, did well to point out the facts. He referred also to the curious case of the B.M.A. resolution, passed at its 1961 annual meeting, which has done much harm to the real case against diesel pollution.

The resolution referred to evidence that "exhaust from well-adjusted diesel engines is more toxic than that from badly-adjusted engines" and called on "the Government to reduce air pollution from this source"—presumably by requiring engines to be badly adjusted! The Council of the B.M.A. have sought advice from the Director of the Medical Research Council's Air Pollution Research Unit, and have now reported on the facts (*B.M.J.*, April 28th, 1962). It is shown that the assertion in the resolution was based on a false interpretation of experiments in which animals were subjected to undiluted exhaust gases. Unless you are breathing nothing but the concentrated exhaust gas as it emerges the suggestion is fallacious.

## *The Annual Meeting*

The Annual Meeting of the Society in London on April 25th was well attended, possibly because it was being followed in the afternoon by a meeting that promised to be exceptionally interesting. At the business meeting, with Mr. John Innes in the chair, the re-election of Lord Cohen of Birkenhead as President, and of Mr. Stanley E. Cohen, as Hon. Treasurer, was announced together with the results of the elections for divisional representatives to the Executive Council. The financial statement, once again unfortunately showing a deficit, was approved, as was the annual report for 1961. Members will have received copies of these documents, and they are included in the 1962 edition of the Society's *Clean Air Year Book*, just published.

The afternoon meeting proved to be even more interesting and stimulating than expected. The address on "Problems in Smoke Control Areas", by Mr. P. D. Coates of the Ministry of Housing and Local Government, was practical, penetrating, and—to judge from the flood of questions that followed—stimulating and very much

* The Epidemiology and Social Significance of Atmospheric Smoke Pollution. McDonald, Drinker and Gordon, Harvard Univ., Am.J.Med.Sci., 1951, 221, 325-342.

to the point. Mr. Coates dealt with these most exhaustively, and with touches of a wit that greatly appealed to his audience. The meeting was not reported and so both speaker and questioners could be uninhibited in their remarks. We are pleased however to be able to publish an authorized record of Mr. Coates' address.

## *New Officers*

At the first meeting of the newly elected Executive Council, held immediately after the A.G.M., the two year term of office as Chairman of Mr. John Innes, came to an end. He was given the sincere thanks of the Council for his leadership and guidance during his term—not only of the Council but of the Society as a whole—and mention was made of his many long journeys from and to Paisley on behalf of the Society, sometimes under arduous conditions. Mr. Innes continues in office as President of the Scottish Division.

The previous senior deputy chairman, Dr. J. L. Burn, was elected as the new Chairman. He will need no introduction to most of our readers. He is Medical Officer for Health for Salford, was a member of the Beaver Committee, is active in many other fields of public health, is an author of text-books, and in what spare time he has is an ardent rosarian. Mr. James Goodfellow, Chief Public Health Inspector for Leeds, and Hon. Secretary of the Yorkshire Division of the Society, was re-elected as a deputy chairman, and the new deputy is Mr. T. Henry Turner. He is an individual member who has proved over the years, both in the two Divisions with which he has been associated, and on the Council to be sincere and always to take an active interest in the Society. He is a distinguished metallurgist, and has a wide scientific and technical background.

## *Northern Ireland*

It is with genuine pleasure that we are able to report the establishment of a Divisional Council of the Society for Northern Ireland. A meeting of members of the Society was held at the City Hall, Belfast, on March 15th, and was also attended by the Society's Chairman, Mr. Innes, and the Director, Mr. Marsh. Membership in Northern Ireland is still small, and the meeting was perforce a small one: but it was keen and optimistic about the future, and a Divisional Council was formally established. Officers and a small committee were elected, the Chairman being Councillor Miss I. M. E. McAlery, of Belfast City Council, and the Honorary Secretary Mr. W. E. C. O'Brien, of Castlereagh R.D.C.

## *Money Matters*

With air pollution costing the country £250 millions a year, it always seems odd that the one voluntary organization existing to lessen this burden should be perpetually short of funds and be obliged to neglect a great deal of the work it ought to be doing. With costs always increasing the steady but slow growth in membership is insufficient to make ends meet. And, as mentioned in the annual report, there has been recently a serious loss of staff because of inability to offer adequate salaries. We are grateful to members for their support, but the question has had to be raised whether the time is coming when the minimum subscription rates should be raised. The last increase was in 1958, and there can be very few charges or prices that have remained steady since that date. As many of the subscriptions from corporate bodies are already well above the minimum any changes would mostly affect local authority members, most of whom keep to the minimum figures based on populations. The present minima range from five guineas for the smallest authorities to forty for the big cities. The only criticism of these that we have heard is that they are too modest.

# *Problems in Smoke Control Areas*

by

**P. D. Coates**

*Ministry of Housing and Local Government*

*Address to the meeting of the Society held at the Caxton Hall, London, on April 25, 1962, with the President, Lord Cohen of Birkenhead, in the Chair. The address was followed by a full discussion of comments and questions*

I FEEL presumptuous in talking here about the problems of smoke control areas when some people in the audience have spent a life-time fighting for clean air and most of the others are in daily contact with these problems on the ground, the only place they really matter. My excuse must be that while I do not know nearly as much as you about the detail I do get at my desk in Whitehall a bird's eye view over the whole country south of the border. I think the most useful thing I can do is to use the largest possible brush to paint the picture as I see it, leaving out the detail, and to give you my personal impressions rather than a Ministry view. You will be able to tell me where I have gone wrong in the discussion afterwards.

I will not go into the problems caused by inactivity. There are plenty of them, as we can see from the number of black area authorities who still have no smoke control programmes. A good many are authorities in the mining districts who have been worried about the effect of smoke control on miners getting concessionary coal from the National Coal Board, and we are much hoping that the recent agreement between the Board and the unions will remove these worries so that smoke control can go ahead. But there are others who without this excuse are doing nothing and who still do not realize that the absence of industrial smoke does not mean that the air over a town is clean. In an old book I noted recently that a number of North Shields freeholders and inhabitants had assembled in November 1817 to present to a Mr. John Morley an elegant silver snuff-box in recognition of his leading part in opposing the obnoxious innovation of street lighting in North Shields. In the Ministry we have a small but lively correspondence with the spiritual heirs of Mr. John Morley and the village Hampdens determined to defend their right to pollute their neighbours' air. All this is of course deplorable. But in my view it is something that time will cure if we who do believe in clean air get on. I am personally quite convinced that once we can get a show piece into the window in the form of a large town free of smoke it will speak for itself and for smokelessness, and that the waverers and laggards will then be falling over themselves to get on the band-wagon. If we can move fast it will not be too long now before their eyes are opened, for,

> " *If it is good it will be seen*
> *For good is visible as green* ".

What I want to speak about are the problems of activity, the problems of people who do want freedom from smoke, where the big question is whether one can get on fast enough.

Take the Act first. No legislation ever proves perfect when it comes to be operated, and like all legislation the Clean Air Act is not free from blemishes. For example, it forces you

and us to draw fine distinctions for grant purposes between gas ignition which involves "works" and gas ignition which does not. There are other minor blemishes. But as a whole it has proved a good Act and a workable Act, and no one has yet suggested that it is not a good tool for establishing smoke control areas.

Then there is the administrative procedure under the Act. We recently made sweeping changes in the administrative procedure required. We do not feel apologetic about the original procedure, which was reasonable and appropriate for the early stages of new legislation in a new field, but it had outlived its usefulness and had begun to hold up progress by giving local authorities and the Ministry too much work on each order. Changes in the requirements about house-to-house surveys and financial estimates are meant to make it easier for local authorities to get more orders to us quicker, and to make it easier for us to confirm quickly unopposed orders. If these changes do not meet the case we shall have to think again, though it is no good expecting confirmation in under two months or so, because of the six-week period allowed by the Act for the lodging of objections.

Next comes grant. There are always bound to be headaches as between councils and householders and councils and the Ministry about details of grant, about what is admissible for grant and what is not, and new problems will go on cropping up to replace the ones that are sorted out. But I believe that these are, and will remain, marginal difficulties, and that the grant system generally works pretty reasonably all round.

Perhaps I should temper this optimistic view about grant a little by emphasizing that my bird's-eye view has so far largely been confined to estimates. For some reason which is not too clear, final costs take a very long time to come in. Too few have come in yet for any general conclusions to be drawn, but there is a hint of a general tendency for the final costs to be lower than the estimates. If that really is the tendency I suspect that it is disturbing rather than reassuring, because it probably means that householders are not making the changes they should.

I should like to add too that in administration there are disadvantages as well as advantages in every change, and that every change brings new problems. We need not expect the new administrative procedure to be the sole exception. Now that the Ministry is seeing less of the detail, there is more danger of interpretation varying from one local authority to another. Some degree of variation is no doubt inevitable and acceptable, but it is undesirable for it to go too far. That is something which may need to be watched under the new procedure.

If is safe to say that nothing holds up a local authority's progress with smoke control more than public inquiries into formal objections to orders. It is heartening to see that most orders are entirely unopposed, and, where there are objections, how small a percentage of the people affected by the order usually object. This is therefore not something to get out of perspective, but it is important enough for it to be useful to consider what types of objection may be lodged.

The great majority of spontaneous objections lodged by individual householders fall into one of three classes. First, some objectors feel that other local forms of air pollution, such as railway smoke, diesel smoke or industrial emissions, ought to be tackled before the domestic chimney. In some ways this is encouraging, for it shows the growing public awareness of air pollution, but it is sad to see how widespread the failure still is to incriminate the domestic chimney as the main source of smoke. The Beaver Committee emphasized the importance of the domestic chimney as a source of smoke, but we now know that it is a considerably more important source than even the Beaver Committee realized. Here there is plenty of scope for more education of the public.

Second, the objector may claim that smoke control is more urgently needed in another part of the district. This type of objection is particularly liable to occur where the council have not publicised an over-all programme of smoke control and where, perhaps, they have started off with an " easy " area on the outskirts or with few houses. Third, objections may be based on dislike of solid fuels alternative to coal.

Objections of this last sort usually derive from a dislike of the cost of premium fuels or from a dislike of the performance of coke. This is something which deserves a close look.

It is pretty clear that coke is going to have to be widely used if the black areas are to be cleaned up at the speed we want, because the present production of premium fuels is not big enough to meet the whole potential demand for open fire fuel. That might perhaps not be so if a great deal more of the present premium fuels were produced, or if the National Coal Board succeeded in producing and marketing on a big scale the smokeless fuels they are trying to develop. But even then many people will like coke better than premium fuels because it is cheaper, just as many people now use the cheapest grade of house coal.

Objectors claim that coke fumes are bad for asthma and bronchitis, or that coke fires spit, or go out, or are otherwise unsatisfactory. Yet there are plenty of people outside smoke control areas who have by choice been using coke on open fires for years, not because they have to but because they like it. There is a puzzling and inadmissible gap between the experience of people who choose coke and are well satisfied and the views of these objectors. Does this not suggest the importance of following up complaints about coke and trying to find out what the trouble is in each individual case? Coke does not give out fumes which are not given out by coal, and that is something which can hardly be explained too often. Bad results may be due to using the wrong grate or the wrong sort of coke. Difficulty of lighting is a frequent complaint, and that points to encouraging the installation of integral gas ignition, which has generally been found the best way of lighting coke. This feeling against coke seems to me the most troublesome thing in smoke control areas at present, and perhaps the one to which most continuing thought needs to be given by all concerned, including of course the distributors. Clearly much of the trouble comes from prejudice, or misuse, or wrong supplies, and these are all things that should be capable of being successfully tackled.

It would be quite unjustifiable to suggest that objections are a sign that a local authority's public relations or publicity are poor, but I do suggest that where there are objections to smoke control orders there may be a need to consider intensifying public relations and publicity efforts. What form they should take will depend on local circumstances, and there can be no single magic formula. Middlesbrough recently got out an attractive pamphlet. Other local authorities may prefer some quite different approach. Shell-Mex and B.P. have just made a clean air film which may be useful.

To sum up on objections, they show that there is still plenty of room for convincing the public that the domestic chimney is the chief culprit and that coke can give satisfaction. The more that can be done about this the better. The Ministry has no intention of overlooking its own responsibilities here.

Finally, let us look at the supply of solid smokeless fuels. Accepting coke as a suitable fuel, and speaking about the country as a whole, there are enough supplies. There may be local pockets where supplies are less easy, but the solid fact is that no smoke control order has ever yet had to be turned down because of supply difficulties.

I said I was going to paint with a broad brush. We all know that there are lots of minor problems and difficulties in setting up smoke control areas, but I do not myself see any

major obstacles in the way if one looks at the question in the broad. Does this sound complacent? If it does, it should not. The fact is that it has been taking a longish time to clean up even the area where the local authorities are most ambitious, in other words the County of London. We are greatly hoping that the administrative changes we have just made will permit quicker action. May I repeat my personal belief that what we most need is a show-piece, a smokeless city? This is a field in which nothing will succeed like success. So far even in the County of London the change is not yet so great that it hits you in the eye, and that is where we want to hit people.

I now look forward to learning from your criticisms of what I have been bold enough to say, and am most grateful to be given this opportunity of increasing my knowledge.

---

**Smokeless Fuel Costs**

In the House of Commons on April 16:

**Mr. H. Wilson** asked the Minister of Pensions and National Insurance if he is aware that old-age pensioners, and others in receipt of social security benefits, are suffering hardship as a result of the requirements enforced by Smoke Control Orders; and what steps he proposes to take to alleviate the position.

**Mr. Boyd-Carpenter:** I have been carefully into this question, and I am advised that it does not necessarily cost more to use smokeless fuels than other types of fuel. But, as I told the hon. Member for Salford East (Mr. Frank Allaun), the National Assistance Board does consider exceptional cases on their merits.



*Members of the North West Division at the Bold Colliery, of the N.C.B. near St. Helens, during a recent visit*

# *Clean Air on the Screen*

## Shell's New Film

A NEW film, entitled " Clean Air " has been produced by Shell Mex & B.P. with the advice and co-operation of the Government departments concerned in the subject. It was made by Random Film Productions, is in colour, and runs for 21 minutes.

It is, without reservations, to be commended for showing, as education for clean air, on every appropriate occasion, and we hope that the local authorities will make full use of it. The story it tells is, of necessity, very much the same as in other films, but it has its own approach and treatment, and it presents the need for clean air and the way to obtain it in a concise, direct and lucid manner. It deals first with the importance of the air we breathe, and the need for its cleanliness. Then, from describing some of the harmful effects of pollution it passes on to the prevention of smoke, with a simple but adequate sequence on smoke control areas, conversions, and the alternatives to the coal fire. It touches on the industrial problems, and ends with an appeal for clean air that is most convincing.

Shell has a high reputation for its films, and its library includes some of the best documentaries ever made, many of which are for public service and not for the promotion of oil. " Clean Air " is a worthy addition to the list. It is hardly necessary to say that it is completely impartial on the smokeless fuels and methods, and it would be impossible to guess either from the film or the spoken commentary that anyone concerned with it had a special interest in any smokeless product. The commentary is straight, quiet, and never unduly emphatic or emotional. The photography is admirable and the colour, especially in the scenes of an industrial city, is unobstrusive because it is so true. Some of the shots of smoke—as of



*". . . Let your glance travel over the roof tops in many districts and you won't see a single plume of smoke ". Scene and comment from the film*



*" Every day of our lives, each one of us breathes* 3,000 *gallons of air into our lungs to purify our blood and keep us alive. We can't see this air we breathe, only feel it ruffling our hair—or rippling the grass when the wind is blowing . . ."*

light grey domestic smoke against a dark blue roof—are very fine, and among the best we have seen. Especially telling is a long-distance view, towards the end, of a town shrouded in a wintry smoke haze. This suddenly clears and vividly reveals the town " all bright and glittering in the smokeless air ". A trick, perhaps, but one that succeeds.

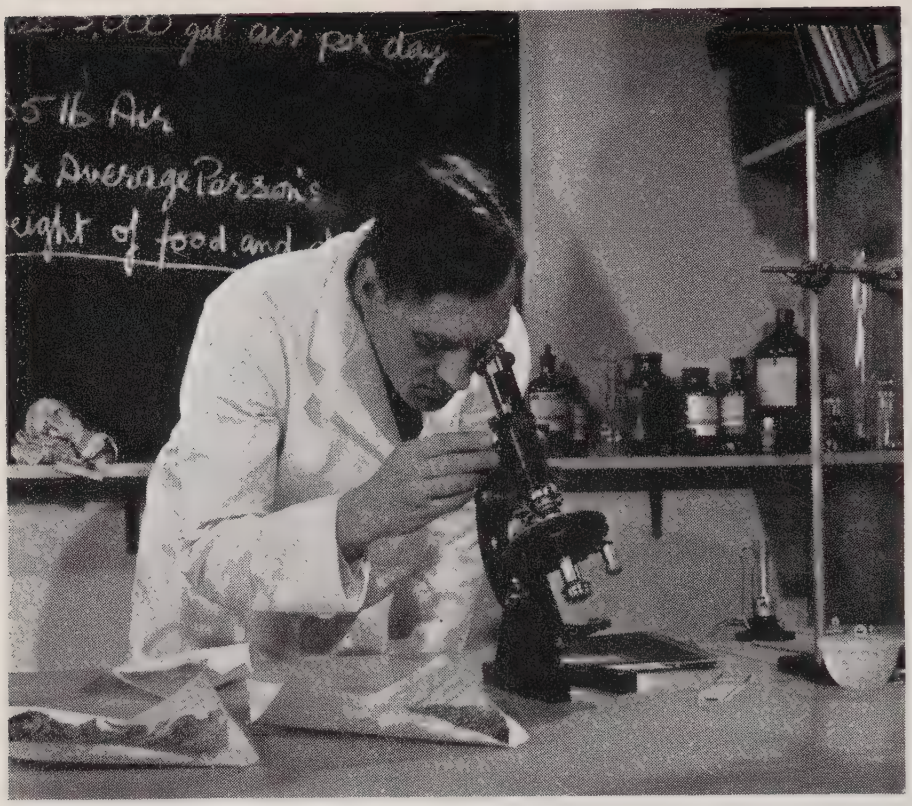
Smoke can be photographed; clean air cannot. That is always one of our problems. This film, however, gets as close as is physically possible to portraying clean air—in the opening sequence of the children on a cliff top, with the breeze ruffling the long grass; and the city children standing on a wall and looking through the railings, with the wind blowing back the hair and skirts of the little girls. The evocative feeling for the air, and the movement of the air, and the natural use of children, is wonderfully effective in creating the mood that so much helps to convince.

The first public showing of the film was at the conference of the N.S.C.A. Scottish Division at Perth, when it was received with enthusiastic approval.

Copies of the film may be obtained on free loan in 16 mm. or 35 mm. Inquiries should be made to the Public Relations Department (Films Division), Shell-Mex and B.P. Ltd., Shell-Mex House, Strand, London, W. C. 2. In Scotland inquiries should be made to the Public Relations Dept., Scottish Oils and Shell-Mex, 53 Bothwell St., Glasgow.

### Dr. Hill on the Film

Dr. Charles Hill, Minister of Housing and Local Government, speaking after having seen the film, said that it




*". . . In order to see what it is in smoke that makes us choke and cough when it grows thick, it's possible to collect some for looking at through an optical microscope."*

could be of real value. It showed how smoke control affected individual householders and was just the sort of information needed by people whose homes might soon be in smoke control areas. It would be shown by the Ministry at the annual conference of the National Society for Clean Air in October, and local authority representatives there would be able to decide whether they could use the films in their own districts as part of their local clean air campaigns.

The Minister said he would be delighted to see the film on television or in cinemas, and added: " As Minister responsible for clean air, I am grateful to Shell-Mex and B.P. for commissioning this film. It is yet another example of the social service films which they do so well. It is a most professional job, and I hope it will have big audiences and excellent results."

" Heaven knows," said Dr. Hill, " there are plenty of good reasons for cleaning up the air we breathe. Chronic bronchitis—sometimes called the English disease—kills 30,000 people a year in this country, and loses us 20 million working days. We can and must get rid of the filthy smoke blanket which shrouds our big towns—and ' shrouds ' is only too apt a word."

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**Bristol and West Committee**

" Clean Air—An Investment in Health " was the title of a paper read to the Bristol and West Clean Air Committee at a conference held in Bristol on March 29. The author was G. Graham Don, J.P., Lecturer in Public Health, London School of Hygiene and Tropical Medicine. Discussion was opened by G. W. Dhenin, Deputy C.P.H.I., Bath.

**Cement Works Deputation**

In reply to a question in the House of Commons the Minister of Housing and Local Government has indicated that he will receive a deputation from the Thamesside Joint Committee for the Abatement of Atmospheric Pollution to discuss the question of the cement works dust nuisance in the area.

# THE N.C.B. SMOKELESS FUEL

*By*

*W. Idris Jones, C.B.E., Ph.D.*

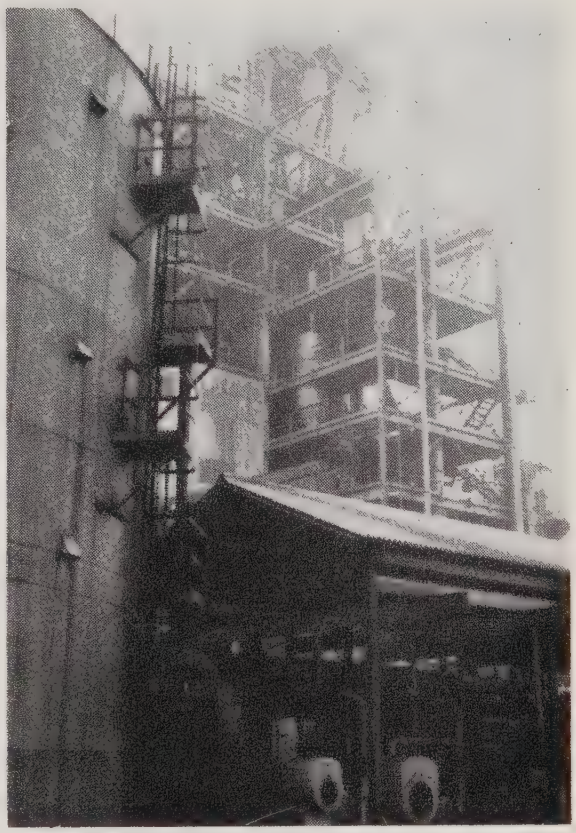
Director-General of Research, National Coal Board

*On April 18, 1962, the West Midlands Division of the Society was privileged to be the first invited party to visit the N.C.B.s Pilot Plant at Birch Coppice, Warwickshire, where smokeless fuel is now being produced by the new process described in an address given to the members present by Dr. Idris Jones. This followed the annual general meeting of the Division, and after lunch a tour of inspection of the plant was made.*

AFTER briefly describing the characteristics of the various types of coals mined in Britain, Dr. Idris Jones stated that the Beaver Report, published in 1954, envisaged the extension of smoke control areas in which the use of coals containing not more than 20 per cent. of volatile matter or manufactured fuels having similar smokeless properties would be used. This meant that either new sources of smokeless fuels would have to be found or some seven million stool bottom grates would have to be replaced by appliances suitable for coke, or both.

According to the Clean Air Act of 1956, which was based on the Beaver Report, householders in smoke control areas were restricted to the use of anthracite or low volatile steam coals, high temperature cokes, low temperature carbonization fuels, briquettes carbonized in the process of manufacture, gas or electricity. Therefore if they want an open fire they must use an improved grate to burn the authorized fuels, or if they retain a stool bottom grate in which coke cannot be burnt they must use the more costly manufactured fuels.

The National Coal Board made an appraisal of the general smokeless fuel problem and concluded that it would be necessary to evolve a new method of making reactive smokeless fuels cheaply from coals in plentiful supply, *i.e.* the Midlands high volatile coals. Any such method should be capable of giving a maximum yield of solid smokeless fuel and involve minimum capital and operating costs. The Board in their submission to the Peech Committee undertook to supply at least one million tons a year of additional premium smokeless fuel. In their review of possible developments they recognized that high temperature cokes required special coking coals,



*A view of part of the Birch Coppice Pilot Plant*



*West Midlands Division members at Birch Coppice*

long carbonizing times of up to 20 hours and ovens or retorts of small individual capacity. Low temperature carbonization too required special coals of limited supply and special types of ovens of relatively low daily throughput. Phurnacite required the low volatile dry steam coals of South Wales and special chambers of small individual capacity.

They therefore turned to a consideration of the possibility of applying the fluidization technique previously used in Germany about 40 years ago for gasification and in the United States for making char for use in power stations, together with high yields of tar. The speaker was sent out to the U.S.A. in 1951 to review American work and following his recommendation to the Board, fluidization research work was pursued with vigour at Stoke Orchard.

The early work, undertaken with the use of a 2-in. diameter reactor indicated that high volatile, non-caking coals were rendered smokeless when the volatile content was reduced to 23 per cent. at 425°C. This is a higher volatile content than that of normal low temperature carbonization fuels and permits a high yield of solid smokeless fuel.

Work was continued using reactors of 8-in. and 18-in. diameter, the latter having a potential coal throughput of six tons a day. Various methods of heating the coal were considered and it was decided to use the simplest method, namely burning a part of the coal charge using the necessary air to fluidize it. It was found that the char produced at about 420°C. could be briquetted at that temperature by means of a mechanical or hydraulic extrusion press and after 1955 research was concentrated on this process. A 500-hours continuous test in the 18-in. carbonizer, linked with a 2-in. bore press, was successfully completed at the end of 1959. By this time too encouraging work had also been done on the briquetting of the hot char in a double roll press using pitch as a binder or using no binder at all.

Thus it was established at Stoke

Orchard that high volatile, non-caking coals can be carbonized to give a char which can be briquetted to give a premium, smokeless fuel for the open fire. To give good combustion properties it is desirable that the ash content of the coal does not exceed five per cent. and that the coal be ground to minus one-tenth of an inch size. For most of the coals tested the optimum temperature was 420°C. and this could be held with a variation of only ±1°C. in temperature at any one point within the reactor. Residence times of five to 50 minutes were tried and times of appreciably less than 30 minutes were found to be adequate.

The fuels produced in this way are easily ignitible and refuelled. They give pleasant flames and excellent radiation. They have a high bulk density and therefore burn for a long time before refuelling is necessary.

All the above work was done to provide data for the design of the pilot plant at Birch Coppice, which the party inspected after lunch. These data were supplied to the Lummus Company in 1958 and they started building the pilot plant in October 1959 and completed it in October 1960. The acceptance tests were completed in April 1961.

In the Birch Coppice plant high volatile Warwickshire coal is washed in the colliery washery to an ash content of not more than five per cent. and conveyed by belt to the pilot plant bunkers. Thence the coal is conveyed to the crushers and then to the dryers where its moisture content is reduced to two per cent. The dried coal then passes to the fluidized reactor and is carbonized at about 415°C. The char is briquetted hot in a mechanical and hydraulic extrusion press and the briquettes pass along a cooler conveyor and are finally quenched. A double roll press is also provided.

The pilot plant fluidizer has fulfilled expectations and the present programme of development is designed to give as soon as possible fuels for comprehensive market trials and special information for the design of a commercial plant. A contract with the Lummus Company for detailed design work was placed in October 1960.

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# *Electricity in Scotland*

**North of Scotland Hydro-Electric Board, Annual Report, 1961. H.M.S.O. 5s. 6d. net.**

**South of Scotland Electricity Board, Annual Report, 1961. H.M.S.O. 5s. net.**

ELECTRICITY supplies in Scotland continues to expand, in the North of Scotland area by 11·3 per cent and in the South of Scotland area by 13 per cent on the previous year.

In the area of the North of Scotland Board 1,782 million units were sold and the maximum demand on the system, excluding the island generation, was 623,000 kilowatts; an increase of 16·4 per cent. on 1960. Sales of electricity to the South of Scotland Board amounted to 780 million units and purchases of off-peak energy from that Board 29 million units.

7,248 new consumers were connected during the year bringing the total to 400,180.

Of the 2,909 million units sent out 2,726 came from hydro-electric stations. The year was favourable for hydro-generation and the financial results were influenced by the large proportion of hydro-generation at a low cost of 0·6483d. per unit.

There is 884,512 kilowatts of hydro-

electric plant in operation. 562,546 kilowatts at constructional stage and 578,800 under survey. The thermal station at Dundee is being extended. The output from the steam stations at Aberdeen and Dundee, mainly during the winter months, amounted respectively to 11,615 million and 102,023 million units. The average coal cost was 107/9d. per ton.

The installed diesel plant of 44,697 kilowatts sent out 69,770 million units. It is proposed to reinforce the diesel plant at Brodick in Arran by laying a 33,000 volt submarine cable across the Kilbrennan Sound between Kintyre Peninsula and the island. A 33,000 volt cable is to be laid across Loch Linnhe at the Corran Narrows to supply Ardgour.

Progress was made in changing consumers from d.c. to a.c. supply and 272 consumers only remain on d.c. supplies.

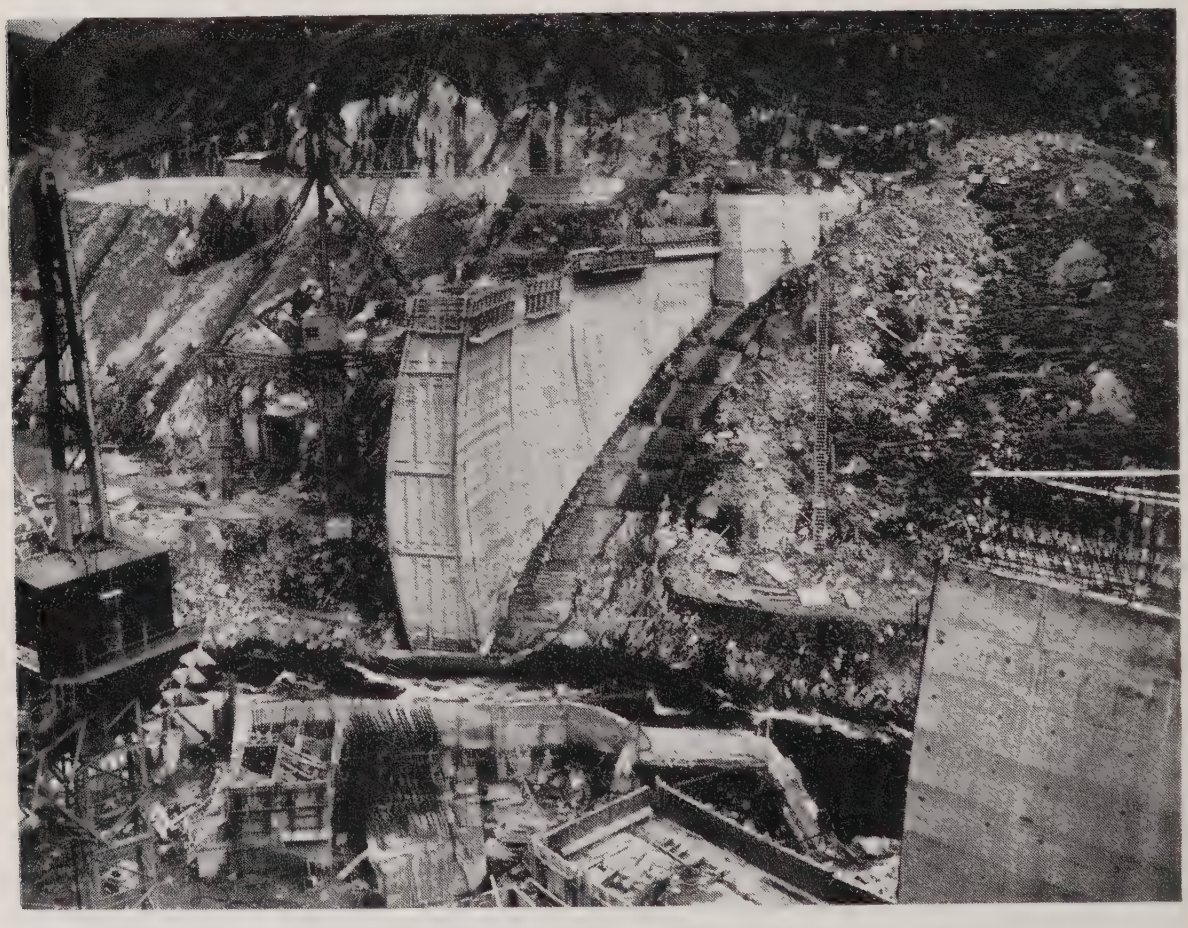
The capital involved amounts to £227,968,000; in hydro-electric schemes £155,756,000, steam and diesel stations £5,544,000, transmission lines £155,756,000, steam and diesel stations £5,544,000, transmission lines £19,042,000 and distribution £45,575,000.

The average price per unit paid by consumers was 1·7298d. per unit. The total revenue for the year amounted to £17,342,262 and the net surplus for the year after meeting interest charges amounted to £1,687,560. This covered the accumulated deficiency of £531,030, leaving £900,000 for transfer to general reserve and a balance of £256,530.

**South of Scotland**

The South of Scotland Board sold 8,083 million units at an average price of 1·526d. per unit.

The total output capacity amounted to 1,819,000 kilowatts—1,697,000 steam and 122,000 hydro-electric. The maximum demand on the system amounted to 2,402,000 kilowatts and occurred between 11.30 a.m. and 12 noon on December 27, an increase of



*The Monar Dam, Glen Strathfarrar*

18 per cent. over the previous year. At that time 97·5 per cent. of plant was available and there were imports of 382,000 kilowatts from the North of Scotland Board, 173,000 kilowatts from the Chapelcross station of the United Kingdom Atomic Energy Authority, and 72,000 kilowatts from the Central Electricity Generating Board.

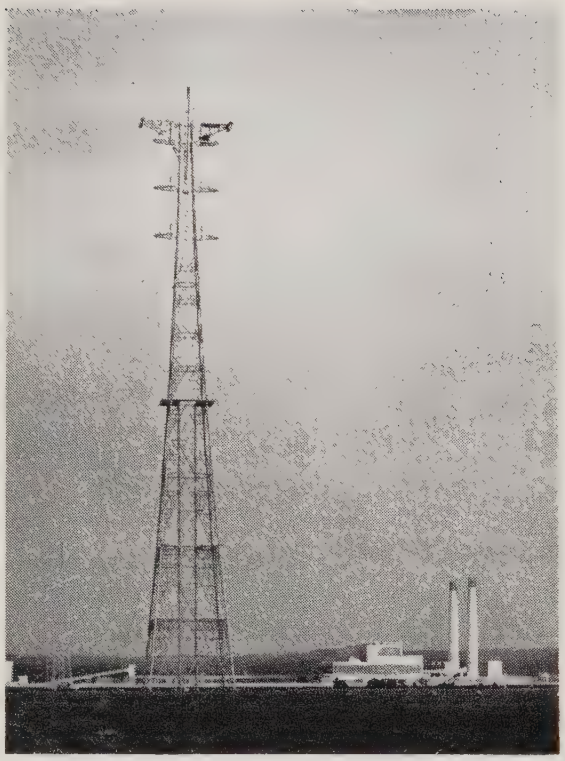
The construction programme envisages the installation of additional plant of 2,244,000 kw. including the 400,000 Loch Awe pumped storage station to be completed by the North of Scotland Board, the 300,000 kilowatt nuclear station at Hunterston and a 28,000 kilowatt slurry burning station at Methil. One of the stations, Cockenzie, East Lothian, will be of 1,200,000 kilowatts capacity, with four 300,000 kilowatt sets operating at 2,350 pounds per square inch, 1050°F. During the year under review one 60,000 kilowatt set was installed at Braehead, and a 24,000 kilowatt station at Kelty was acquired from the National Coal Board. The low pressure station of 13,000 kilowatts at Dunfermline was closed down.

The construction at Hunterston has been delayed and the first reactor is unlikely to be commissioned before May, 1964.

The thermal stations consumed 3,515,732 tons of coal, 340,111 tons of washery slurry and 16,924 tons of coke breeze. Thermal efficiency of generation was 27·61 per cent. compared with 27·27 per cent. in 1961 and 24·74 in 1955. Kincardine station had an efficiency of 33·88 per cent. The average cost of coal was 100/9d. per ton.

Extension to both the 275,000 volt and the 132,000 volt transmission system is proceeding. In the crossing of the Forth by the 275,000 volt line the north tower will be 440 feet and the south tower 505 feet high.

The Board continues its research in collaboration with the North of Scotland Board, the Electricity Council and the Central Electricity Generating Board. It is proposed to erect an experimental 275/400 kV line on Douglas Moor to study in conjunction with the Generating Board the characteristics of various forms of conductor assemblies in high winds. Protective effects of various forms of grease coatings for insulators have been studied at Leatherhead.



*The 505 ft. tower ready for stringing the 275,000 V. conductors over the River Forth at Kincardine*

The off-peak supplies continue to expand and now amount to 404,099 kilowatts, distributed between space heating, furnaces, water heating, process heating and miscellaneous. The load factor of the system is 43·4 per cent.

One hundred and eighty-two farms were connected during the year and 94·9 per cent. of all farms in the Board's area are now connected.

The average price per unit sold in 1961 was 1·526d. per unit. The total revenue from sales of electricity amounted to £51,388,000, from contracting and sales of fittings £4,778,000 and miscellaneous revenue £624,000, which resulted in a net surplus of £444,000. The total capital assets of the Board amount to £270,200,675.—*A.J.C.*

# A Review of the Domestic Smoke Problem

**By Arnold Marsh, O.B.E., M.Sc.Tech., M.Inst.F.**

*Director, N.S.C.A.*

*Address to the East Midlands Division of the Society at Kettering on March 22, 1962*

DOMESTIC smoke has for long been recognized as a major constituent of the air pollution from which we suffer, and its importance was fully confirmed by the Beaver Committee on Air Pollution in 1954. Since then, however, new evidence and new examinations have shown that it is even more serious than had been thought. It is no exaggeration to say that today it is more harmful and wasteful than all other forms of pollution put together.

The reasons for this assertion may be briefly described.

Even on the actual weights of pollution emitted the latest estimates show that smoke from household chimneys is responsible for two-thirds of the total smoke, even though the grit and dust emission is much less than that from industrial sources.[1] The other important constituent of the pollution, sulphur dioxide, is discussed separately, below.

It is, however, less the total weight of emission that matters as much as the amount of it in the air we breathe—that is, in the near ground level, or at house-top level. High-level emissions are normally dispersed, and their concentration, when they return to earth, is greatly attenuated. This does not mean that they may be ignored, but it does mean that low-level emissions may be more serious, and among these household smoke is the largest and most widespread pollution. Road and rail vehicles are responsible for other low level emissions, but except in certain localities are of lesser importance.

The effects of domestic smoke are further increased by its concentration during the cold and smog-prone months of winter, when clean air is especially important.

The effects of the smoke are in themselves more harmful and wasteful, compared with other forms of smoke, by reason of the way in which smoke from the open coal fire is produced.

The comparatively low temperature at which the volatile matter in the coal is distilled off in the open fire means that the resultant smoke has a much higher hydrocarbon or tarry matter content than industrial smoke. The short distance it has to travel in the flue before its discharge into the atmosphere means less opportunity for the coagulation of the particles, so that domestic smoke is composed of very small particles which are taken deeper into the lungs than are coarser particles. Further, not only is the smoke discharged at a low level, but it is cooler and has a lower velocity than industrial chimney emissions, so that it more readily eddies or drifts down to a lower level—which can be very frequently observed.

Because of the gross inefficiency of the open fire for burning coal the proportion of the coal substance that is lost as smoke is far greater than the loss from a factory chimney emitting dark smoke. Research by the British Coal Utilization Research Association[2] has shown that for every ton of coal burned under smoke-producing industrial conditions the weight of smoke is of the order of 0·2 per cent. of the weight of coal; whereas from the stool-bottomed open domestic grate the loss is between 2 per cent. and 6 per cent. In other words, for every ton of coal burned industrially up to $4\frac{1}{2}$ lb. may be lost as smoke, while for every ton burned in the open coal fire

the average loss is 90 lb. This is the most primitive and wasteful way of burning hard-won coal imaginable.

The effects upon health of the respiration of this fine, almost mist-like smoke, with its high hydrocarbon content, in association with sulphur dioxide, though not yet fully understood, are undoubtedly serious, and may well be more serious than is generally realized. There can be little doubt that there is a close association between smoke and bronchitis, and more recently there is evidence showing an association between smoke and cancer of the lung. Much publicity has recently been given, and rightly so, to cigarette smoking as an agent in the causation of lung cancer, but it must be remembered that diseases of this kind are more likely to have multiple causes than a single cause. Smoke, and especially domestic smoke appears to be the second most important factor. The latest report on this by Dr. Percy Stocks,[3] shows a strong correlation between lung cancer mortality ratios and smoke concentration in a number of localities, and a striking expression of these findings in diagrammatic form has been published in *Smokeless Air*.[4]

A further factor that has only recently been clarified is that the concentration of smoke in a town does not depend on the size of the town but upon the density of population and the domestic coal consumption per square mile. This was discussed in an important paper by F. P. Williams, of the Warren Spring Laboratory, at the Harrogate, 1960, conference of the National Society for Clean Air.[5] A town like Kettering, for example, will suffer as much from domestic smoke as any part of a large city such as Birmingham, Nottingham or London. The author also showed that the smoke deposits in any town, other than in an area of concentrated industry, were 70 to 90 per cent. of domestic origin.

*Sulphur*

To conclude this section of the paper reference must be made to the problem of sulphur dioxide, especially as it is sometimes said that this is really the most dangerous constituent of air pollution, and that it will remain even when smoke is abolished.

It is true that sulphur dioxide is a pollutant we must seek to remove by every way that is possible, but it is unfortunately also true that there is no satisfactory solution in sight. Sulphur dioxide is bound to be emitted from coal, from the smokeless solid derivatives of coal, and from heavy fuel oil. The only way known of removing it from the flue gases is the washing process in use at the Battersea and Bankside power stations, where the system used is expensive, limited in its application, and open to criticism on the ground that the small amount of sulphur left after the washing may do more harm than if the gases had not been washed.

It is possible that the most harmful effects of sulphur dioxide are to be found when it is emitted in association with particulate matter, and that if smoke is abolished, and grit and dust greatly reduced, the gas will become so diluted that the harm it does will be far less. This view is supported by the absence, as far as is known, of any concern about sulphur dioxide in the U.S.A. cities where smoke has been virtually abolished, but where sulphur dioxide is presumably continuing to be released.

Nevertheless, even if the means for direct prevention are not yet in sight, sulphur dioxide from domestic sources may be reduced considerably. It is prevented altogether by the use of gas and domestic oil, and its effects minimized by the use of electricity. Electricity generated by nuclear or water power is of course the ideal, but even from our modern coal and oil fired stations the sulphur dioxide is discharged at a height, temperature and velocity that results in a fall-out concentration far less than that from equivalent coal consumption in individual coal fires.

Although the solid smokeless fuels retain sulphur in about the same proportions as the coal from which they have been manufactured, it should be emphasized that they can and should

be used at a higher efficiency. For equal amounts of heat, therefore, the weight of fuel used, and therefore the sulphur dioxide emitted, is reduced. If, for example, there was a general change-over from open coal fires at 25 per cent. efficiency, to closed stoves at 65 per cent. efficiency, the sulphur dioxide emission would be cut by two-thirds.

It must not be inferred from what has been said about domestic smoke that other sources of pollution can now be given less attention. Industrial smoke is still serious, although diminishing, and dust and grit problems are of increasing concern. And, of course, there are industrial problems which, in certain localities, may overshadow the domestic problem. There is also the increasingly serious problem of pollution from road vehicles, both diesel and petrol. To urge a greater effort against domestic smoke by no means implies that the other questions should be given less attention. We shall achieve our objective of clean air only by keeping up the attack on pollution all along the line.

**The Means for Prevention**

So much has been said and written in recent years on the means available for abolishing domestic smoke, and they are so well-known, that little new can be said.

Negatively, the answer is simple—the replacement of bituminous coal in the home by other forms of fuel or power. To achieve this, gas, electricity, oil, and the various forms of solid smokeless fuel, all have their part to play. To advocate all of these, competitive though they are in many ways, is desirable, not just to be fair and unbiased, but because if with their help we are to succeed in our objective of clean air, all of them will have their work cut out to play their parts. We are only just now beginning to make significant progress in turning Britain into one big smoke control area, and the real demands on the smokeless fuel and power industries are yet to come. It must be remembered that there are still more than 30 million tons of coal a year being burned—or perhaps distilled is the better word—in our homes.

It is fortunate that the demand for clean air should coincide with the independent public demand for ways of heating that are cleaner, more efficient and more convenient, and which happen also to be smokeless. Good progress towards clean air is in fact being made for reasons other than clean air. Much of this—such as central heating—is, however, in the homes that can afford to pay more for heating amenities; the hard core of the problem lies with the far more numerous smaller homes where, even today, cost rather than value must come first.

There is no need to survey the different smokeless methods, and combinations of methods, that can be used, or to compare their relative costs. This can only be done properly at some length, and one need only refer to the excellent way it has recently been considered in the book *Domestic Heating*,[6] edited by W. F. B. Shaw. But a few observations on the different fuels, to draw attention to certain factors, may be made.

*Solid Fuels.* Since the majority of people prefer to continue to use solid fuel, partly out of custom and partly because it can be cheapest, this presents the biggest problem. Custom, rather than economy, creates the demand for the open fire and therefore, in smoke control areas, for open-fire smokeless fuels. There is no shortage of solid smokeless fuels, except from time to time, and locally, of the more freely-burning fuels; that is, those capable of burning on any kind of open fire. The most abundant fuel of all, gas coke, is as such beginning to disappear from the scene, and is being replaced by a British Standard Specification product, which rightly has its own trade name—" Gloco." Similarly, a standard quality hard coke, for boilers and stoves, is distinguished by the name " Sunbrite." Still around the corner are the new smokeless fuels being developed by the National Coal Board.

One of the problems to be solved in new smoke control areas is to ensure that the use of smokeless fuel is popular and no more expensive than burning coal. Among the things needing attention are more education, guidance and publicity; the sale of all fuels under their distinctive names, with an ending of the vague and not very popular term "coke"; and greater direct encouragement to use the more efficient convector fires, or better still, the even more economical openable stoves.

*Gas*, thanks to the trend towards central heating, in which market it is taking an important share, and to the remarkable advance in single room space heaters, is playing an increasingly valuable part in the drive for clean air. Gas heating can now be obtained at less cost than the stool-bottom coal fire.

*Electricity* shows constantly increasing use, much of which is materially helping smoke prevention, although for long-period heating, e.g., heating a living-room throughout the day, cost is still a limiting factor. For new houses and flats underfloor heating is an important development, as is the use of off-peak power for night storage heaters. The heat-pump, too, has its potentialities.

*Oil* is assisting mainly by its use for central heating, but also by individual room heaters. These, however, appear to be used mainly for short period heating and to give warmth in halls, bathrooms, etc., rather than as a main source of room heating.

As has been stressed, the greater part of the smoke control area programme is yet to come. Will the smokeless methods that are available be able to meet the demand? The general opinion is that they will, and that there need be no insurmountable obstacle in the way of steady progress towards complete urban smoke control. An important assessment of the situation was made by the Peech Committee on Solid Smokeless Fuels,[7] and reference may also be made to the address at the Brighton Conference, 1961, of the N.S.C.A. of the Parliamentary Secretary to the Ministry of Power, Mr. John C. George, M.P., and to the paper at the same conference by Mr. David E. Baird.[8]

How exactly the demand will be shared depends on the trend of public demand during the next decade, and both for smoke control and for the most economic utilization of fuel and capital for the fuel industries, it appears to be desirable to steer demand towards the widest diversity of fuels and methods. In particular, it seems to be necessary to encourage the greater use of gas, off-peak electricity, and of oil for central heating, to ease the coming load on the production of high-quality smokeless fuel. The need for this will be increased if, as seems probable, total gasification of coal develops and replaces the traditional carbonization process that gives us gas and solid fuel.

Here we come against the basic problem of how to meet the heavy winter demand for fuel and power, including the super-peaks that although they may be rare, must be met. Solid fuel and oil have an advantage here, because they can be stored for such peak requirements at small capital cost. Electricity cannot be stored and for it to have to meet an undue proportion of the winter peaks would mean heavy capital investment in stations used only for a small fraction of the year.

The storage of gas is also severely limited, at least at present. Two developments may however make it possible for gas to take a much greater share of the winter peak loads—the importation of liquefied methane, and the underground storage of gas. It is a pity that the first attempt to develop this technique in this country should have failed, because it can do a great deal to assist the promotion of clean air and the reduction of sulphur dioxide.

**Objections and Difficulties**

All reforms have their difficulties

and teething troubles in securing acceptance, and here and there in different parts of the country a minority opposition, usually only temporary, is encountered. It is sometimes quite genuine and sometimes artificially fomented by those who conceive it to be in their interest to obstruct or delay the changes in the pattern of fuel usage that are occurring. Such objections make news and tend to look bigger and more serious than they are and, though treating them seriously, they must be kept in perspective. After all, there are now nearly a million homes in smoke control areas and smokeless zones, some with nearly a decade of experience, and the vast majority of people have accepted and adjusted themselves to the new conditions without a grumble. There are also thousands of other homes, outside the control areas, which have voluntarily turned over to smokeless methods.

The reasons for opposing or criticizing smoke control are few in number. They turn up regularly from all parts, and are easily countered. A few notes on the more common may be useful.

*Smokeless methods are more expensive.* They will of course be more expensive if additional warmth, comfort and convenience are desired and can be afforded. But they can also be the cheapest possible way of providing heat in the home. The simple coal fire that is being replaced costs 2s. 8d. for every useful therm of heat; the convector open fire using Gloco costs 1s. 7d., and the closed stove, using Sunbrite, costs 1s. 1d.[9]

When complaints about cost are made they are usually due to the burning of the more expensive free-burning fuels (which will burn on any grate) being used wastefully on grates without proper draught control or throat restriction.

*Unsatisfactory burning.* This is generally due to the faulty installation of the appliance, wrongly spaced firebars, inability to work it properly, the wrong size or quality of fuel, or faults with the chimney. Householders should be encouraged to seek expert advice if burning difficulties are experienced.

*Fumes.* The fallacy that coke or other smokeless fuels emit fumes into the room dies hard. It seems to have originated with the fumes from the watchman's brazier, where of course the smoke and fumes from coal would have been intolerable. All fuels on burning emit products of combustion or fumes, and if any do enter the room the fault is with the appliance or the flue and not with the fuel. The combustion products from a solid smokeless fuel fire are the same as those from a coal fire less the smoke. After the volatiles have been driven off a coal fire is in fact a coke fire.

*Interference with Individual Liberty.* It is interesting to see how often this cockeyed argument crops up, " Why cannot we burn what fuel we wish in the privacy of our home? " to quote a recent letter in a local paper. The answer, of course, is that you can—provided that you keep the smoke you produce in the privacy of your home. It is putting it into the public atmosphere, to the detriment of your neighbours, that is the real interference with liberty—the liberty of breathing unpoisoned air.

*Spitting.* The spitting into the room of small fragments of shale, still occasionally complained of, is a valid objection and should of course be prevented in any fuel that may show this characteristic.

*Storage.* The greater bulk of carbonized fuels leads to difficulties in storage where facilities are limited, and is a justifiable complaint. The answers are more adequate storage in new houses and the organization of more frequent deliveries in small lots, uneconomic though this may be. The excellent little concrete bunkers, readily available at moderate cost, as supplementary stores, are excellent where there is room for them, and they are having a good sale.

**Smoke Control Areas**

It will be recalled that the Beaver Report on Air Pollution, in 1954, urged domestic smoke prevention by " a continuous programme urgently and insistently carried out over a number of years," and said the objective of their recommendations was " that by the end of ten to fifteen years the total smoke in all heavily polluted areas would be reduced by something of the order of 80 per cent."

Although progress towards this objective is continuous it is far from being urgent or insistent. We are seriously behind schedule. Eight years after the report we should at the very least be approaching the half-way stage, but instead, for the black area authorities in England and Wales that *have* submitted programmes, the fraction of the target figure that had been reached at the end of 1961 (in acres) was a mere 7·8 per cent. And, it must be noted, out of the 325 authorities in the black areas, no less than 118 have not yet submitted programmes. (In fairness it must be pointed out that included in the 118 are a number of authorities in the coalfields, where action may have been delayed because of the concessionary coal difficulty.)

Even among the authorities which have submitted programmes the intention, in too many instances, is not being achieved. Thus for 1961 the programmes estimated 477,781 premises to come under smoke control; the number actually reached was 337,422. In acreages, the figures are 90,403 and 61,169 respectively.

The complete figures, to the end of 1961, for the black areas in England and Wales are as follows:

| | *Premises* | *Acres* |
|---|---|---|
| Smokeless Zones (local Acts) .. | 41,060 | 3,400 |
| Smoke Control Areas in operation | 561,692 | 100,347 |
| Orders confirmed or submitted .. | 368,151 | 57,873 |
| Areas where smokelessness is a condition of tenancy .. | 10,815 | 976 |
| TOTALS .. | 981,718 | 162,596 |

In addition, there are 36 smoke control areas outside the black areas, and in Scotland there is one smokeless zone, 16 smoke control areas in operation and 14 orders confirmed or submitted.

This is definitely not good enough, and it is greatly to be welcomed that the Ministry should quite recently have taken two important steps to speed things up. They have, first, greatly simplified the administrative procedure for setting up smoke control areas, and secondly have reiterated the earlier request for programmes and a target date. The information obtained from the first inquiry was published as Command Paper, and it is intended to issue a new one on the revised estimates now being asked for. The Ministry points out that the new simplified procedure will save time in executing the programme, and asks the authorities to take full account of this.

The forthcoming Command Paper is being looked forward to with much interest and hope. The laggard authorities will now have less excuse than before for not taking action, and it is hoped that those who still fall behind will receive appropriate publicity.

To digress for a moment, it is of interest to recall that the Society, in the memorandum it submitted to the Beaver Committee said that " the central Government should not only be more ready to approve initiative by local authorities, but that it should in fact stimulate it." It is gratifying to find that what was then a pious hope is now a reality.

The reasons for this slow rate of progress should be examined. The first is that some local authorities, even today, and even in the black areas, do not appear convinced that domestic smoke control is necessary—or necessary for them. More are likely to agree in principle but are not interested enough to start things really moving, or have fears that solid smokeless fuels will not be in adequate supply. Others are afraid of the cost involved, or have staff problems they are not prepared

to overcome. A few seem to have been intimidated by organized or vociferous opposition.

Among the authorities that are in the lead there are more understandable difficulties, and it is hoped that the simpler procedure now in force will overcome these. On these problems, and on success in meeting them, reference may be made to the paper by G. W. Herrick, and the instructive discussion upon it, at the Society's Brighton conference last year, recently published.[8]

On the not uncommon fears about supplies of smokeless fuels and the cost of conversions two observations may be made. There has not yet been a case of a smoke control order proposal having been turned down because of insufficiency of fuel. In the northern region, where open fire fuels are in shorter supply than fuel suitable for closable appliances, the Minister has made these more expensive appliances available for grant. And, of course, in the mining areas the agreement between the National Coal Board and the Unions concerned on the replacement of concessionary coal by smokeless fuels is a big and very welcome step forward.

On the cost of conversions, or the share of them to be borne by the local authority and the householder, it need only be pointed out that this is a small and once-for-all expenditure that should be set against the cost of air pollution to the community. The average cost of pollution to a town family is £30 a year, and although this will not be wholly wiped out (because of the passed-on costs included) until the whole country has virtually abolished smoke, it is an annual cost which makes trivial any conversion cost.

## Conclusion

In conclusion, the domestic chimney is now the most serious single source of air pollution in Great Britain, and its harmful consequences are now known to be greater than had previously been realized. The problem is being solved, but at a slower pace than is possible and desirable, and the necessary action is lagging behind the practical progress that could be made. Solid smokeless fuel supplies are satisfactory but future progress can best be ensured by encouraging a greater diversity of use of gas, electricity and oil. The criticisms and difficulties that have been encountered in developing the smoke control area programme are small in comparison with the success that this has attained, as shown by its effectiveness in what is now approaching a million homes. But a great deal more education on the importance of clean air is needed among both the general public and a not inconsiderable number of local authorities.

To the latter one cannot do better than repeat the admonition that ends the Minister's Circular of January 30, which asks local authorities in the black areas who have not yet prepared programmes " to consider again most carefully whether their present policy is consistent with the health and well-being of their communities."

## References

1. Clean Air Year Book, N.S.C.A.
2. See Smokeless Air, No. 110, Summer, 1959, 273.
3. Brit. J. Cancer, 14 Sept., 1960, 397-418.
4. Smokeless Air, No. 119, Autumn, 1961, 24.
5. Pollution Levels in Cities, F. P. Williams, Proc. Harrogate Conf. 1960, 83-88, N.S.C.A.
6. Domestic Heating, Ed. W. F. B. Shaw, London, 1960.
7. Report of the Committee on Solid Smokeless Fuels, Cmnd. 99., H.M.S.O. 1960.
8. Proc. Brighton Conf., 1961, N.S.C.A.
9. 6 above, p. 41.

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### Coal in Smokeless Zones

As coal is still being delivered in smoke control areas in Deptford, the council is reported to be seeking powers to prohibit coal deliveries to householders in such districts. Investigations by the Public Health & General Purposes Committee have been followed by representations to the London Boroughs' Joint Committee and to the Minister of Power.

# *INTERNATIONAL SECTION*

*Australia*

## THE NEW SOUTH WALES CLEAN AIR CONFERENCE

***From J. L. Sullivan,***

*Chief Scientific Officer, N.S.W. Division of Occupational Health*

UNDER the joint sponsorship of the New South Wales Department of Public Health and the University of New South Wales, Australia's first conference to be devoted to the discussion of the problem of air pollution was held in the University of Sydney on February 19, 20 and 21 this year. Similarly to most other developed countries throughout the world, Australia, in its larger cities and industrial centres, has begun to be affected by increasing atmospheric contamination and most States have introduced or are considering the introduction of more effective control legislation. In New South Wales a comprehensive Clean Air Act was adopted by Parliament in 1961 and it was considered that this created a suitable occasion for a conference.

Approximately, 300 representatives from Governments, Municipal Authorities, Universities and Industries from all Australian States and New Zealand attended. In addition, two invited overseas guests, Mr. W. A. Damon of Great Britain and Dr. Morris Katz of Canada were at the Conference and presented two papers each. The Hon. W. F. Sheahan, Q.C., LL.B., M.L.A., Minister for Health, opened the Conference and in his address drew attention to the need for the co-operation of all sections of the community in facing air pollution. He stressed that research and education shared at least equal importance with legislation in any control programme. The first day of the Conference was devoted to the subject of legislative and administrative procedures and one paper each was presented from Australia, Great Britain, Canada and the United States. During the remaining two days, papers relating to the measurement, effects and control of pollution were presented.

In view of its recent adoption, details of the legislative and technical provisions of the New South Wales Clean Air Act given in a paper by the present author were of topical interest to most of the audience, particularly to the large number representing industries likely to be most affected by the new measures. The audience was told that the new Act was based largely upon a synthesis of the British Alkali and Clean Air Acts and allowed for a system of licensing and supervision by technically trained officers of the New South Wales Department of Public Health. It was pointed out that, through the licence fees which in some cases could be as much as £500, it was hoped that it would be possible for about half the cost of establishing and equipping the new scientific control organization to be provided. In this way, it was expected that an expert group, capable of providing technical assistance to industry, rather than acting as a purely inspectorial body, could be formed.

### W. A. Damon and Morris Katz

The description of air pollution problems and legislation in Great Britain by Mr. Damon and in Canada by Dr. Katz were also received with great interest. Mr. Damon outlined the long history of the attempts to control smoke and other air pollution in Britain and gave details of the Clean Air Act of 1956. He described many

of the undesirable effects of air pollution including the many deaths which have resulted under extreme circumstances but he also pointed out that some pollution is an inevitable consequence of modern industrial development. Amplying this he said " Much as we should like to have perfectly clean air to breathe, we have to remember that we can't live on clean air alone—we must have some bread and butter as well—and our industries are the way to that bread and butter and, if we are lucky, a little jam to go with it." However, he expressed the strong view that the same energies devoted to the maintenance of the purity of food and water should be devoted to the air we breathe. In this regard, Mr. Damon complimented the New South Wales Government for taking action to control air pollution at a stage when many of the remedies could be applied relatively painlessly. Dr. Katz described, in broad detail, some of the important air pollution problems in Canada including those which had reached international significance such as the Trail Smelter in British Columbia and smoke in the Detroit-Windsor area. The former of these was a subject of considerable controversy early in the present century when fumes from the smelting plant in Canada were causing large-scale damage to farm crops in the United States. The outline of the problem and the methods used to solve it, described by Dr. Katz, were of more than usual interest to many people at the Conference especially as pollution from smelting plants has caused difficulties in New South Wales.

For the remaining two days of the Clean Air Conference, technical contributions from various Australian States were presented as well as additional contributions by Mr. Damon and Dr. Katz. As the time for presentation of contributions was purposely limited, ample discussion periods were allowed and these added substantially to the value of the Conference. Though it is impossible to list the actual titles of papers here, it would be accurate to say that there were very few sections of the whole range of air pollution knowledge not covered. As well as those discussed, two additional papers were received from the United States and will be included in the final volume of the Proceedings.

**Exhibition**

Outside of the actual presentation of papers there were other facets of the Conference which will be remembered. An exhibition of equipment for the measurement and control of air pollution in the laboratories of the Department of Fuel Technology attracted a great deal of interest. Exhibits included apparatus for the determination of various gases and solids in the atmosphere, stack testing equipment, pilot scale plant for the control of dusts, gases and odours, a new electronic dust sizing instrument and various other items. At the end of the first day's lectures, a film entitled " Report on Smog," which the organizers of the Conference had been able to borrow from the United States Public Health Service, was shown. This presented an up-to-date account of the nature of the problem as it exists in Los Angeles to which Sydney bears some similarity and hence was of more than usual pertinence. Many very complimentary remarks were made about the quality of the film. Some of the pleasanter moments of the three days occurred during the social arrangements including an Official Dinner held on the evening of the opening day. Here, many of the participants were able to meet each other in an informal atmosphere and continue some of the discussions of the day. From beginning to end, interest in the Conference was maintained and the Organizing Committee has been highly delighted and gratified by the many congratulatory remarks made during and after the three days proceedings. The substantial task of preparing for printing all of the papers and the discussion is now in progress and the issue of a final volume of the Proceedings of the New South Wales Clean Air Conference will be made in the not distant future.

*Netherlands*

## Effect of air pollution on mosses and lichens

At the sixtieth anniversary of the Royal Netherlands Natural-Historical Society (December, 1961) a meeting was held at which the influence of environmental pollution on man, animals and plants was studied. At this meeting a very interesting paper on air pollution was presented by Dr. J. J. Barkman, head of the Biological Station of the Agricultural University.

The chief part of Dr. Barkman's paper covered the influence of air pollution on a number of species of mosses and lichens.

In different parts of the country, mostly in densely populated and industrialized areas, a number of species have completely disappeared. By studying these " deserts " valuable information on the distribution of air pollution over the country may be obtained.—*Dr. L. J. Brasser, Research Inst. for Public Health Engineering.*

*Argentine*

## Latin American Clean Air Conference

A Conference entitled " Air Pollution " will take place in Buenos Aires, Argentine, from October 29 to November 2, 1962. Organized by the Municipality and the National Institute of Industrial Technology, the programme of the Conference will include papers on the medical aspects of air pollution, industrial and domestic problems, and effects on animals and plants. A special session will be devoted to the pollution arising from diesel and petrol vehicles and the methods of controlling it.

*U.S.A.*

## Recent Conferences

Two May, 1962 conferences dealing with clean air are reported from the United States. The American Industrial Hygiene Association at its conference in Washington (13th to 17th) included a section on air pollution in which a number of technical and scientific contributions were presented and discussed.

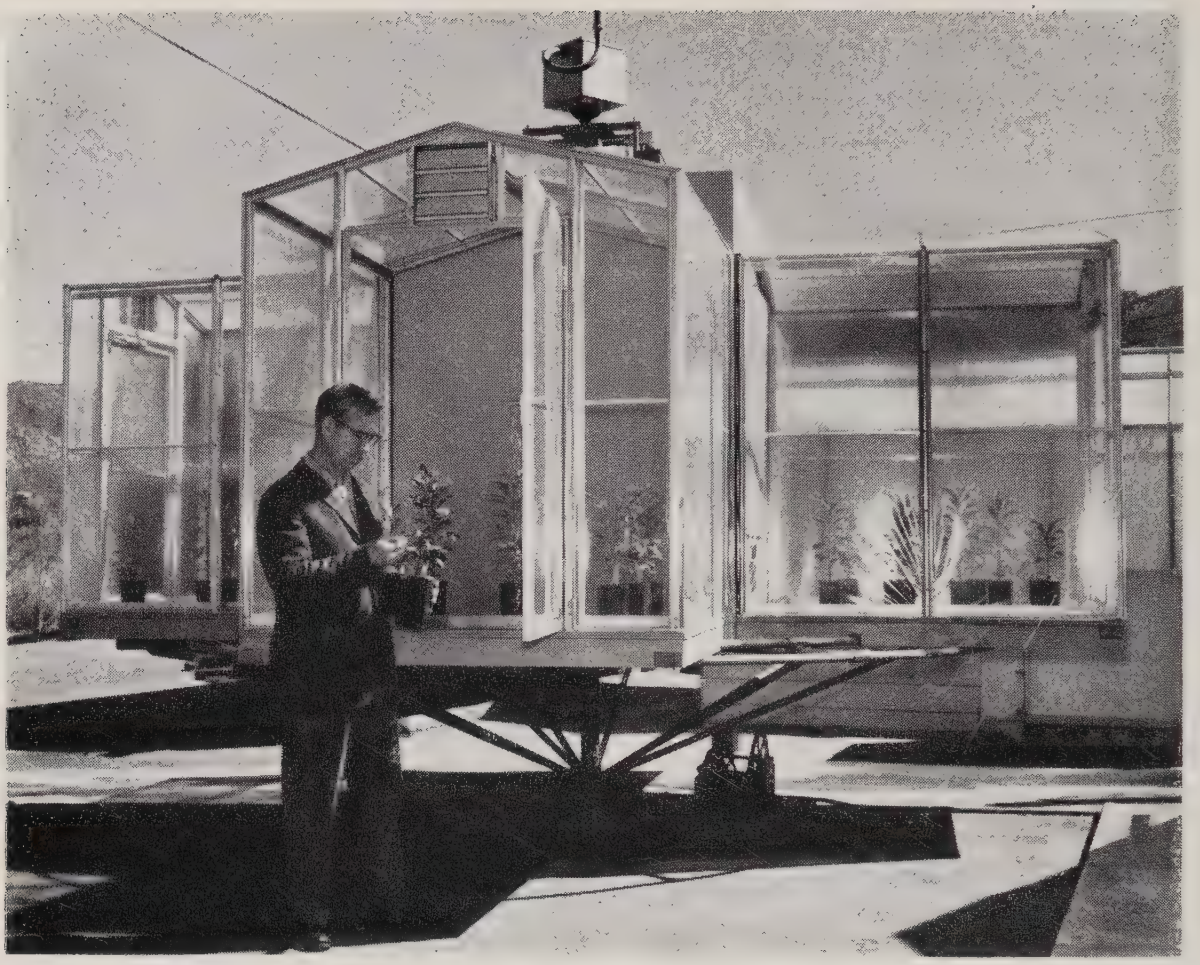
From the 20th to the 24th of the month the Air Pollution Control Association held its 55th annual meeting at Chicago. The mammoth programme contained 93 papers. The " Keynote Session " was on " Community Approach to Air Pollution Control," and the other sectional headings were: Community Surveys, Meteorology, Research, Administration and Facilities, Automotive Vehicle Emissions, Control Equipment and Systems, Health, Methods, Odours, Instrumentation, Radioactive Fallout, Legal Seminar for Officials, Officials Conference, and Sampling and Analysis.

### National Conference

A National Conference on Air Pollution, sponsored by the Public Health Service, will be held at the Sheraton-Park Hotel in Washington, D.C., on December 10-12, Surgeon General Luther L. Terry announced recently.

Using the theme, " Let's Clear the Air," the conference will bring together doctors, engineers, scientists, legislators, and representatives of business, labour, and civic organizations to explore how air pollution can be better controlled throughout the country.

" Air pollution is a health hazard," commented Dr. Terry, " and causes economic damage measured in billions each year. Our conference in 1958 stimulated a great deal of progress, but nationally we are still far behind in applying available knowledge to the actual control of air pollution sources. It is time to appraise where we stand in meeting the threat of air pollution, and to determine what additional co-operative action must be taken by all levels of government, industry, and the public to improve the air we breathe."



*Rotating greenhouse chambers, to ensure uniform lighting, for investigations on air pollution effects on plants, which has been designed by Robert F. Brewer, Associate Chemist, Citrus Experimental Station, Dept. of Soils and Plant Nutrition, University of California*

**Possibilities**

Bearded inventor James F. Lathers, of Imperial Beach, California, has been working on an anti-smog device, and has gotten two traffic tickets for producing "excessive exhaust". Lathers admits his invention is not ready for the market but adds, " it has possibilities ".—*United Press International.*

**New York's Heavy Pollution**

More than 262,000 tons of soot were deposited on New York last year—nearly 70 tons per month per square mile over the city's 320 square miles.

Extensive demolition of buildings and the burning of rubbish at demolition sites were responsible for a major share of smoke, smog and other forms of air pollution, according to the Department of Air Pollution Control.

In Manhattan, some 89 tons per square mile every month was recorded, but this was 100 tons less than in 1960.

**Clean Air for Ulster**

A resolution calling for consideration to be given, as a matter of urgency, to a Clean Air Bill " in view of heavy air contamination in built-up and industrial areas in Northern Ireland " was carried by an overwhelming majority at the Ulster Unionist Council's annual conference recently.

Mr. William Morgan, Minister of Health, told the conference that the Ministry had been closely examining the form which legislation to deal with air pollution might take. Good progress with the preparatory work had been made and he hoped in the not too distant future to be in a position to indicate the course which the Government considered practicable.

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The Sheffield Clean Air Committee, as a result of complaints from local householders about the quality of smokeless fuels available, made arrangements to visit a smokeless fuel plant to enable them to see how the fuel is produced.

# NEW PUBLICATIONS

Of value to technical workers, writers and libraries is the new **British Technology Index.** Published by the Library Association, this is a monthly subject-guide to articles in current British Technical journals. It is comprehensive and the numerous entries are under classified headings, with cross-references to related headings. A very useful and well-produced job. The annual subscription for 11 monthly issues and a bound annual volume is 15 guineas, post-free, or $50 U.S.A.

From the British Iron and Steel Federation comes their attractive and well-illustrated **Annual Report, 1961.** It reports another year of progress, with much information on programmes, developments and statistical matters.

**Six Years of Research in Air Pollution** is the title of a report from the Public Health Service of the U.S. Department of Health, Education and Welfare. It is a review of grants-in-aid, contracts, and direct operations sponsored by the Division of Air Pollution, Bureau of State Service. It is a 290 page publication, and the extent of the ground covered is shown by the appendix of 623 references to papers, etc., described in the text. This is an important literature source book for all engaged in either A.P. research or in studying the research that has been or is being done in the U.S.A.

The same department has published the **Report of the Committee on Environmental Health Problems,** which include a section from the subcommittee on air pollution, as well as reports on many other subjects in the public health field.

**Chemical Reactions in the Lower and Upper Atmosphere** (Interscience Publishers, John Wiley & Sons, New York and London; pp. 390. 105*s*. net) is the report of the proceedings on an international symposium arranged by the Standford Research Institute, San Fransisco, in April 1961. It includes 25 papers of a strictly scientific and technical character, which indicate the very considerable amount of detailed research being conducted in the U.S.A.

Another publication of specialist interest from the U.S. is **Spray Literature Abstracts** (National Science Foundation and American Society of Mechanical Engineers, pp. 383). Compiled and edited by Kalman J. De Juhasz, it covers the wide fields of atomization, particle size problems, fog formation, and related subjects. Many of these have direct bearings on combustion studies, the prevention of pollutant emissions, etc.

We have received recent copies of the **Archives of Environmental Health,** the official publication of the American Academy of Occupational Medicine, published by the American Medical Association. Among the contents of the February, 1962, issue, which we have before us, are articles on "Industrial Bronchitis and the Function of the Lungs", "Cancer of the Lung in an Industrial Population", a review of "Exposures to Oil Mists", and "Some Implications of Ambient Air Quality Standards". The April issue contains an important article on "Air Pollution as a Public Health Hazard", by R. A. Prindle, to which we hope to make further reference.

**The Warren Spring Laboratory Report for 1961** (D.S.I.R., pp. 34, H.M.S.O., 4*s*. net) devotes its first section to air pollution. The report outlines the work on the new National Survey of air pollution (for a more detailed account of which see the Warren Spring paper at the N.S.C.A., Brighton, 1961, conference) and briefly mentions the " laboratory study of a proprietary process for the desul-



**WAITING FOR SMOKE CONTROL. A remarkab**

phurization of industrial flue gases ". This, it is stated, is sufficiently promising for the work to be extended to pilot scale, and a pilot plant capable of treating 16,000 cubic feet of flue gas per hour is now being installed.

There is a fuller, and most interesting review of smoke pollution in towns. Analyses of smoke pollution figures for 1958-59 on a regional basis suggest that towns in the north of England tend to be more polluted by smoke than towns in the south, with the exception of London. A table shows that for the areas examined the average smoke concentrations in microgrammes per cubic metre, are as follows: South of England, 118; Outer London, 140; Inner London, 219; North of England, 219.

The average smoke concentration for urban areas is of the order of 200 microgrammes per cubic metre, and a table is given of *sites* where the yearly average is less than one half of this, i.e., a figure of 100. Lerwick and Stornaway lead with 3 units, but the table shows that among the others in the list of 29 sites are some in places not yet associated with the idea of clean air. Thus there is a Sheffield site (47), Bingley (57), Wolverhampton (59), Woolwich (59), and Lewisham (96). A footnote points out that " the measurements at these individual sites are not necessarily representative of a town as a whole."

Footnotes, however, have a habit of being overlooked, and Wolverhampton has for instance been hailed in the Press as a smokeless town. The figure given, it is pointed out, refers to a site in the centre of the town, with little smoke emission in the immediate surroundings. The Sheffield site is high on the moors to the west of the city and five miles from the centre, and the Bingley site is $1\frac{1}{2}$ miles from the centre of this industrial town. " Results such as these," states the report, " show the basic soundness of the policy of smoke control areas." They show that the contamination of the air in the centre of a town by smoke emitted in other parts is comparatively small; that heavy pollution by smoke hardly spreads at ground level from the town in which it originates; and that the air at ground level can remain relatively uncontaminated even on the perimeter of that town.

*Diesel Exhausts*

In a paragraph on this problem the report says " Efforts at Warren Spring Laboratory to find a cheap, simple method of removing smoke from the exhaust gas of diesel engines have been no more successful than else-



**photograph of household smoke in a northern city**

where. It is generally recognized,however, that the emission of smoke does not occur if the engine is properly maintained and operated.

*Divisional News*

## CONFERENCE AT PERTH

Because of a little delay in publication we are able to report on the annual conference of the Scottish Division at Perth on May 17 and 18. With the Divisional President, John Innes, in the Chair, the conference held two sessions. The first was on industrial smoke, with an address by R. Bunting, Scottish Area Engineer of N.I.F.E.S., and the other on " Clean Air and Comfort in the Home ", with contributions by G. S. Bowman of the North of Scotland Hydro Electric Board (who illustrated his talk with an amusing home-made strip cartoon), J. E. Wilkes of the Scottish Gas Board, and H. Giblin of the Solid Smokeless Fuels Federation. A fourth contribution was to have been made by T. S. Millar of Scottish Oils and Shell-Mex, but he very altruistically gave up his time to allow for a showing of the new Shell film, " Clean Air ".

On the Thursday afternoon a coach trip was taken to view the Pitlochry Hydro Electric scheme. Delegates were entertained to lunch on the first day by the Perth Town Council, and the conference ended with a lunch given by the Division.

The conference was marked by the retirement after fourteen years of office of the popular Hon. Secretary and Treasurer, Norman Fraser. Tributes were paid to him for his valuable services and a presentation (a fishing rod), subscribed for by the delegates, was made to him. A presentation was also made to Mrs. Fraser for the help she had given to her husband and the Division.

*North East Meeting*

Last year the North East Division were the guests of the National Coal Board for their annual meeting. This year, on February 22, the Division met at the Northern Gas Board in Newcastle-upon-Tyne. Visits and inspections were made during the morning, and after lunch as guests of the Board, there was the annual general meeting, followed by papers and discussion on " The Gas Industry's Contribution to Clean Air ". Addresses were given by Officers of the Board.

# SOLID FUEL IN THE FUTURE

## *Torquay Conference*

A conference on " Design and Heating in the Future " was held by the Coal Utilization Council and the National Coal Board at Torquay on March 24 and 25. Under the presidency of Sir Campbell Hardy, Director of the C.U.C., the conference was organized to interest the architect and heating engineer and was attended by over 200 delegates.

Lord Robens opened the conference, and there were five papers, as follows:

" Architectural Design Trends," by A. G. Sheppard Fidler, City Architect, Birmingham; " Providing the Heating System for Modern Building Design," by Dr. F. M. H. Taylor, President, Institution of Heating and Ventilating Engineers; " The Economic Approach to Heating in the Future," by E. F. Schumacher, Economic Adviser, N.C.B.; " Heating Appliances of the Future," by J. S. Williams, Deputy Director-General, N.C.B.; and " Solid Fuels of the Future," by Dr. J. Bronowski, Director-General, Process Development Dept., N.C.B.

A few points made by the speakers:

Mr. Fidler said the trend today was for local authorities to build to higher densities, in mixed development schemes, including multi-storey flats, in order to save land. The trend towards compact building made it more worthwhile for close study to be given to the wider use of district heating and the use of mechanical refuse destruction, such as the Garchey system, with continuous incineration and heat recovery. Where there was to be a central source of heating, buildings must be economically grouped around the boilerhouse.

Dr. Taylor, in the course of his address, said: " At present the heating and ventilating engineer, and, indeed, the architect, is governed very much by the ideas of his clients and frequently the fuel supplier is brought in as an afterthought when plans and designs are virtually completed. What I would like to see is one or two show or demonstration units sponsored by the fuel supplier which, with the collaboration of both clients and architects, takes all the human requirements and engineering trends of the future into consideration."

Dealing with problems of central plant generating hot water or steam for housing estates, or a central boiler house serving a block of flats, Dr. Taylor referred to the question of individual metering (which has often been said is essential if district heating is to be economic), and said that this could be done cheaply and effectively, by means of a motorized valve thermostat. A record could be kept of the number of hours per week that the valve was opened.

Among new developments mentioned by Mr. Williams was a fully automatic boiler with an output of 10,000 Btu/hr. to provide full central heating and hot water. Fuel would be supplied by gravity from an overhead bunker, holding a month's supply, and replenished direct by delivery vehicle. The ash, removed automatically, would flow to an outside container to be removed weekly by the dustman.

Dr. Bronowski, in his paper, on smokeless fuels, referred to the disappointment at slowness of progress expressed by the Select Committee on Nationalized Industries.

" Let us be realistic," he said. " We know that our policy in making a radically new smokeless fuel is right. We know that the objective is right, and we know that the fuel is right. None of these has been criticized. What slows us down is not the technical difficulty; we have solved that in the laboratory. What slows us down is the economic problem. We, the National Coal Board, do not merely have to make the fuel—we have to make it pay. The progress of our development is dictated by the need to make the new fuel in millions of tons at a price which the public can afford."

# SMOKE CONTROL AREAS

## Progress Report

### POSITION TO MARCH 31, 1962—TOTALS

| | England and Wales | Scotland |
|---|---|---|
| **Smokeless Zones** (Local Acts) in Operation.. Acres, 3,400 Premises, 41,060 | 44 | 1 |
| **Smoke Control Areas in Operation** .. .. Acres, 104,432 Premises, 570,496 | 527 | 17 |
| **Smoke Control Orders—** | | |
| Confirmed .. .. .. .. .. | 320 | 8 |
| Submitted .. .. .. .. .. | 115 | 7 |
| **Grand Totals** .. .. .. | 1,006 | 133 |

The list given below are supplementary to the information in the last issue of *Smokeless Air* (Spring, 1962), which give the position up to December 31, 1961. They now show the changes and addition to March 31, 1962.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

### ENGLAND AND WALES

**New Smoke Control Areas in Operation**

Eccles B. No. 1B, Gateshead C.B. No. 3, Halesowen B. No. 3, Islington M.B. Nos. 3 and 4, Newcastle-upon-Tyne C.B. No. 3, Richmond (Surrey) B. No. 2, *Shrewsbury B. No. 1, Stalybridge B. No. 5, Stepney M.B. No. 2.

**New Orders Confirmed but not yet in Operation**

Aireborough U.D. No. 10, Aldridge U.D. Nos. 6 to 12, Ashton-under-Lyne B. No. 3, Barking B. Nos. 2 and 3, Batley B. No. 2, Bebington B. Nos. 3 to 7, Beeston and Stapleford U.D. No. 2, Bermondsey M.B. No. 4, Birmingham C.B. Nos. 6, 35 to 38, 48 to 50, 53 to 60, Blackburn C.B. No. 2, Brighouse B. No. 6, Bury C.B. No. 3, Cambridge B. No. 1, Carlton U.D. No. 1, *Carshalton U.D. No. 2, Chadderton U.D. No. 3, Chatham B. No. 1, Cheshunt U.D. No. 2, Chesterfield U.D. No. 2, Coventry C.B. No. 3, Croydon C.B. No. 4, Dartford B. No. 2, Deptford U.D. No. 3, Dewsbury C.B. No. 4, East Barnet U.D. No. 3, Failsworth U.D. No. 2, Feltham U.D. No. 2, Friern Barnet U.D. No. 2, Fulham M.B. Nos. 5 and 6, Greenwich M.B. No. 3, Hackney M.B. No. 4, Harrow B. No. 2, Hayes and Harlington U.D. No. 21, Hendon B. Nos. 2 and 3, Heston and Isleworth B. No. 4, High Wycombe B. No. 10, Holborn M.B. No. 5, Hornsey B. No. 4, Huddersfield C.B. No. 5, Hyde B. Nos. 2 and 3, Kingston-upon-Hull C.B. No. 9, Kingston-upon-Thames B. No. 2, Leicester C.B. No. 7, Leigh B. No. 1, Lewisham M.B. Nos. 10 and 11, Lincoln C.B. No. 1, Malden and Coombe B. No. 2, Manchester C.B. No. 5, Mirfield U.D. No. 4, Mossley B. No. 1, Nottingham C.B. No. 2, Nuneaton B, No. 6, Padiham U.D. No. 2, *Prestwich B. No. 4, Pudsey B. No. 3, Richmond (Surrey) B. No. 3, Sheffield C.B. No. 9, Slough B. No. 2,

Staines U.D. No. 2, Stepney M.B. No. 3 Stretford B. No. 2, Todmorden B. No. 1, Tottenham B. No. 3, Wakefield C.B. Nos. 3 and 4, Walsall C.B. No. 4, Wanstead and Woodford B. No. 3, Wembley B. Nos. 2 to 5, Westhoughton U.D. No. 2, Westminster M.B. Nos. 7 and 8, *Whitefield U.D. No. 3, Willesden B. No. 4, Wilmslow U.D. Nos. 2, 7, Winsford U.D. No. 3, Wolverhampton C.B. Nos. 2 and 3, Wood Green B. No. 4, Woolwich M.B. No. 14.

**New Orders Submitted for Confirmation but not yet Confirmed**

Acton B. No. 5, Aireborough U.D. No. 10, Atherton U.D. No. 1, Barnes B. No. 3, Bebington B. No. 8, Bethnal Green M.B. No. 3, Bingley U.D. No. 3, Birkenhead C.B. No. 2, Birmingham C.B. Nos. 10, 61 to 63, Blaby R.D. No. 1, Blaydon U.D. No. 1, Bolton C.B. No. 19, Brighouse B. No. 7, Bromley B. No. 4, Camberwell M.B. No. 3, Chadderton U.D. No. 4, Cheadle and Gatley U.D. Nos. 2 to 4, Chelsea M.B. No. 2, Chesterfield B. No. 3, Chesterfield R.D. No. 3, Chingford B. No. 2, Church U.D. No. 3, Dartford B. No. 3, Ealing B. Nos. 8 and 9, East Barnet U.D. No. 4, Elstree R.D. No. 2, Erith B. No. 1, Exeter C.B. No. 3, Gateshead C.B. No. 4, Gillingham B. No. 1, Halesowen B. Nos. 5 to 12, Halifax C.B. No. 6, Hampstead B. No. 4, Harrow B. No. 3, Hayes and Harlington U.D. No. 19, Hemel Hempstead B. Nos. 1 and 2, Holborn M.B. No. 6, Hornchurch U.D. No. 4, Hornsey B. No. 4, Islington M.B. Nos. 7 and 8, Lambeth M.B. Nos. 4 and 5, Luton B. No. 2, Merton and Morden U.D. No. 3, Middlesbrough C.B. No. 3, Morley B. Nos. 10, 13 to 18, Newcastle-upon-Tyne C.B. No. 5, Nottingham C.B. No. 3, Oldham C.B. No. 4, Poplar M.B. No. 14, Prescot U.D. No. 2, Prestwich B. No. 5, Radcliffe B. No. 2, Rochester B. No. 1 Salford C.B. No. 6, Slough B. No. 3, Southall B. No. 4, Southwark M.B. No. 2, Spenborough B. No. 3, Staines U.D. No. 3, Stoke Newington M.B. No. 9, Stretford B. No. 3, Wallasey C.B. No. 7, Wandsworth M.B. No. 4, Warrington C.B. No. 5, Watford B. Nos. 1 and 2, Wednesbury B. No. 2, Wednesfield U.D. No. 4, West Bromwich C.B. No. 8, Westminster M.B. No. 9, Wigan C.B. No. 2, Willenhall U.D. No. 11, Wilmslow U.D. Nos. 6, 8 and 9, Wimbledon B. No. 1, Winsford U.D. No. 2, Yiewsley and West Drayton U.D. No. 4,

## SCOTLAND

**New Smoke Control Orders in Operation**

*Edinburgh (Centre of City No. 2).

**New Orders Confirmed but not yet in Operation**

Grangemouth (Bow House No. 1).
Paisley (Foxbar).

**New Orders Submitted for Confirmation but not yet Confirmed**

Stirling County (Bannockburn No. 1) (Stenhousemuir No. 1).

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# WORKS MANAGERS AND ENGINEERS CONFER ON CLEAN AIR

Organized by N.I.F.E.S., the Leeds Chamber of Commerce and the Leeds Productivity Association, a conference for works managers and works and plant engineers was held at the University, Leeds, on April 3 to 5. It was divided into two parts, the first dealing with productivity and fuel efficiency, and the second with the Clean Air Act.

The conference was well attended, and the papers presented were of a practical character which provoked pertinent and practical discussions. There were three sessions on the Clean Air Act, with seven papers. Three of these are being reproduced in this journal: that by Mr. Middlebrook because he deals with an aspect of smoke control area administration that had not received a great deal of attention; the others because they give in concise form information that will be of practical use to many of ourreaders.

An introductory address on the subject was given by Arnold Marsh, Director of the N.S.C.A., who was followed by J. H. Wyatt, Deputy C.P.H.I. for Leeds, on " The Operation of the Act by the Local Authority ". The other papers, in addition to those we print, were " Modern Trends in Furnace Practice ", by A. L. Hancox and " The Combustion of Unusual Fuels ", by J. C. Stainton, both of N.I.F.E.S.

# The Operation of Large Boiler Plants in Smoke Control Areas

*by*

*C. J. Middlebrook*

*Senior Smoke Inspector, Bradford*

I THINK you will know that the Clean Air Act became law on December 31, 1956; it is the duty of the local authority to apply the provisions of this law. One of the provisions with which we are particularly interested today is the establishing of smoke control areas and the operation of large boiler plants in them.

Firstly, what is a smoke control area? This may be defined as an area established by a local authority in which smoke must not be discharged from chimneys. Certain premises or furnaces, e.g. industrial furnaces burning coal efficiently and almost smokelessly may be exempted wholly or on condition. Any fireplace, this term includes any furnace, grate or stove whether open or closed, which will burn an authorized fuel is automatically accepted as being satisfactory. An authorized fuel is defined by Regulation as being any of the following:

Anthracite
Briquetted fuels carbonized in the process of manufacture (Phurnacite)
Coke
Electricity
Gas
Low temperature carbonized fuels (Coalite, Rexco)
Low volatile steam coal (Semi-anthracite, Welsh dry steam coal)

Any smoke arising from the combustion of an authorized fuel is permissible. Such smoke is accepted and no offence is committed if the smoke arises solely from the use of an authorized fuel. If your boiler plant will burn an authorized fuel you have no problem. A simple example of this case is a factory with a low pressure hot water heating system run from a coke fired sectional boiler. On the other hand if your boiler plant is of such design that, either it cannot be modified to burn an authorized fuel or is essentially coal burning, you are faced with a problem. If the boiler plant is operated on hand fired coal it will mean that either a suitable mechanical stoker will have to be installed or the boiler replaced with a new boiler burning an authorized fuel or coal or oil. An example of this can be found in those factories in which steam power has been replaced by electricity. I am now thinking of a 30 ft. x 8 ft. 6 in. Lancashire boiler which is on hand fired coal. In this case the boiler could be modified by installing one or a pair of worm type underfeed stokers, or one or a pair of low ram coking stokers or chain grate stokers. Oil burners would be another method of solving the problem or the furnaces could be modified to burn coke. In some cases complete replacement of the boiler plant would have to be considered.

Any fireplaces specially designed or adapted for combustion of liquid fuel are considered to be satisfactory, provided that they are so installed, maintained, and operated as to minimize the emission of smoke. A breach of any one condition leaves the occupier

open to legal proceedings. Speaking generally, not much trouble arises from the use of liquid fuel.

With regard to coal burning units, any fireplaces which are installed, maintained and operated as to minimize the emission of smoke are considered to be satisfactory. No fuel shall be used other than that for which the mechanical stoker was designed. Any mechanical stokers designed after December 31, 1956 are assumed to be capable of complying with the law. The local authority should have received notification of any such installation and in some cases will have given " prior approval." Any mechanical stoker installed before December 31, 1956 is considered to be unsatisfactory until it is proved that by design and operation it is capable of meeting the requirements of the new legislation. This legal provision gives the local authority discretionary powers to reject sprinkler stokers as not being capable of complying with the law.

**Exemptions**

The conditions with regard to smoke emissions are exactly the same inside a smoke control area as those outside a smoke control area once a local authority has exempted certain coal burning furnaces. If exemption is not granted, the boiler plant must operate smokelessly. This brings me to a point of considering exemptions. If a local authority grants exemption to a particular boiler plant inside a smoke control area the exemption does not automatically give licence to a management to allow smoke of any quantity or density to be emitted. The exemption is applicable only for the purpose of not burning an authorized fuel. The boiler plant must still be operated in such a manner as to fully comply with the Permitted Periods Regulations. The Regulations set out in clear terms that only smoke of a specific density may be emitted for a specific length of time. The Regulations are based on good boiler house practice and well designed plants can easily comply with them. It is the museum pieces which create the problems.

And now a word or two about " prior approval." The term " prior approval " is used to describe the procedure by which a local authority gives approval for the installation of fuel burning equipment before any work is undertaken by a contractor. In its simplest form the procedure is as follows:

(*a*) Plans and specifications of the proposed boiler plant, furnaces, etc., are submitted by the architect, contractor or owner to the local authority.

(*b*) The details of the proposed work are considered by the Senior Smoke Inspector. He may find it necessary to talk over the particular details with the architect or contractor and make an inspection on site. If all points are satisfied the proposition is submitted to the Health Committee for their approval. It is at this stage of the procedure which is so very important. I always try to collect as much information as possible to avoid pitfalls at a later date.

(*c*) After approval, the applicant is notified and the work can be carried out.

For smoke control to operate efficiently, it is important for the local authority to make known to industrialists the type of equipment which they will accept as being satisfactory. It is also important for the general policy of smoke control to prepare industrial and commercial boiler plants for the time when they will be included in a smoke control order. It is a great lever in getting things done to tell an industrialist who is installing fuel burning equipment now that no additional expense will be incurred when the premises are included in a smoke control area. One cost to satisfy both present requirements and those of a smoke control order at a later date.

Here are a few examples of units which are operating in the smoke control areas in Bradford:

| *Existing Boiler Plant* | *Present Method of Firing* | *Previous Boiler Plant and/or Method of Firing* |
|---|---|---|
| 1 Lancashire boiler | Hand fired coke | Existing Lancashire Boiler Hand fired coal |
| 2 Packaged type steam boilers | Oil fired | 2 Lancashire boilers with sprinkler stokers |
| 2 Lancashire boilers | Oil burners | Existing boilers with sprinkler stokers |
| 1 Cochran boiler | Underfeed stoker | No change |
| 1 Packaged type steam boiler | Oil burner | 1 Lancashire Boiler. Hand fired coal |
| 3 Economic boilers | Chain grate stokers | 3 Lancashire boilers. Hand fired coal |
| 1 Vertical cross tube boiler | Underfeed stoker | No change |
| 2 Economic boilers | Coking stokers | No change |
| 1 Cornish boiler | Oil burner | Existing Cornish boiler. Hand fired coal |
| 1 Cochran boiler | Oil burner | 1 Lancashire boiler. Hand fired coal |
| 2 Lancashire boilers | Chain grate stokers | Existing Lancashire boilers. Hand fired coal |
| 1 Lancashire boiler | Chain grate stokers | Existing boiler with sprinkler stokers |
| 1 Three pass Economic boiler | Low ram coking stokers | No change |
| 1 Lancashire boiler | Underfeed stoker | Existing boiler. Hand fired coal |
| 1 Lancashire boiler | 2 underfeed stokers | Existing boiler. Hand fired coal |
| 1 Thermal storage steam boiler | Oil burners | No change |
| 1 Cast iron Sectional boiler | Underfeed stoker | No change |
| 4 Cast iron sectional boilers | Oil burners | 2 Cast iron Sectional boilers. Hand fired coke |

**Summary**

1. Appliances which are adapted to burn an authorized fuel are acceptable in smoke control areas.
2. Appliances burning a liquid fuel, which are installed, maintained and operated with the minimum amount of smoke, are acceptable in smoke control areas.
3. Coal burning appliances which are installed, maintained and operated and burning the fuel for which they were designed are acceptable in smoke control areas providing the local authority are satisfied that the equipment can operate smokelessly or with the minimum amount of smoke.
4. It is very important for the local authority to decide which fuel burning appliances are, and which are not, acceptable as complying with the new legislation.
5. Worm and ram type underfeed stokers, coking stokers and chain grate stokers are acceptable for burning bituminous coal in smoke control areas.
6. The local authority should make its views widely known with regard to appliances and fuels.
7. Wherever possible, guidance should be given to industrialists to obtain the best results for them and for the local authority.
8. Prior approval should be given by a local authority on the firm understanding that no additional expense will be incurred when the boiler plant is included in a smoke control area.
9. Boiler plant for which "prior approval" has been given must be operated in such a manner as to comply with the law. Prosecutions can be taken for any offences.
10. When exemption is given to a boiler plant located in a smoke control area it only refers to the burning of a fuel other than an authorized fuel, *e.g.* bituminous coal. The exemption does not give licence for the emission of smoke irrespective of volume or density. Prosecutions can be taken when exempted plant discharges excessive smoke into the atmosphere.

# GRIT EMISSION

*by*

*B. Turner, N.E.C.D.*

*National Industrial Fuel Efficiency Service*

THE terms "dust" and "grit" imply a wide range of particle size and in fact the solid particles in the flue gases are spread over a wide range. No precise meaning can be attached to the terms but the Beaver Committee considered particles of size greater than 76 microns as "grit". Dust could therefore be described as all particles below this size although very small sizes—say from a fraction to 3 or 4 microns are often described as "fume". No useful purpose is served by the division, from the point of view of separation, and a better one might be at say 20 microns as this size is approximately the dividing line between particles that follow the gas cloud and those that do not, and also about the point where efficiencies of the more efficient centrifugal separators begin to fall away significantly.

The composition and size distribution of flue gas solid matter depends on the type of firing. The material from chain grate and spreader stokers consists mainly of relatively large grit particles. It is as a rule black or dark coloured and contains a comparatively high proportion of partly burned or coked fuel.

The material from pulverized fuel furnaces is much more finely divided and contains a preponderance of spherical particles that have resulted from the solidification of fused ash. Some of the spheres are hollow and translucent. These so-called cenospheres are light in colour and contain no combustible. They are often broken and because they are hollow the dust formed by them is of low bulk density. Other spherical particles from the ash are solid and there is always a proportion, variable with firing conditions, of partly burned fuel or coke particles. The fly ash from P.F. fired furnaces is usually more finely divided than the fuel from which it comes. (The coal is usually ground to 75 per cent. through a 200 mesh screen whereas the fly ash from it will often pass 90 per cent. through the same screen).

An indication of particle size range from the main firing methods is given in the table below.

As will be seen later, the mechanical types of separator are generally less efficient in the separation of particles at the low end of the size range. They are therefore best suited to the separation of grit from stoker fired installations. Electrical precipitators do not exhibit the fall in efficiency of precipitation of the smaller particles to anything like the same extent and

**Typical Size Analyses for Chief Methods of Firing**

| *Type of Firing* | *Particle size range—microns* | | | |
|---|---|---|---|---|
| | Below 20 | 20-40 | 40-76 | Above 76 |
| Chain Grate .. .. .. | 19 | 12 | 16 | 53 |
| Sprinkler Stoker .. .. .. | 25 | 19 | 14 | 42 |
| Pulverized Fuel .. .. .. | 45 | 33 | 16 | 6 |

they are usually considered necessary therefore for P.F. installations. Several plants have been equipped with a mechanical collector for removal of the heavier particles in series with an electrical precipitator for removal of the finer particles.

**Standards of Removal**

The concentrations of solid particles in flue gases are variable with plant types and especially with conditions of loading but concentrations of the order of 0·8/1·0 grain/cu. ft. are usual with boilers working at steady ratings and fired by chain grate or sprinkler stokers. P.F. fired power station boilers produce concentrations of 4-6 grains/cu. ft. but higher concentrations occur.

There is no statutory limit for the residual concentration in the cleaned gas but the Electricity Commissioners recommended that the total dust concentration in the stack gases should not be more than 0·4 grain/cu. ft. (corresponding with 90 or more per cent. removal) of which not more than 0·15 grain should be of size greater than 20 microns. Higher efficiencies than represented by these figures are usually aimed at however and efficiencies as high as 99·4 per cent. have been claimed from power station electrical precipitators.

**Methods of Removal**

Two main principles are involved in the separation of dust and grit from a gas stream—mechanical and electrical. In the case of mechanical collector, use is made of the variation of forces acting upon the particles or the imposition of an entirely new force, *i.e.* Centrifugal.

1. *Settling*

Settling chambers as such are not often used for the separation of solid particles from flue gases because their efficiency for any but the coarsest particles would be very low unless the chambers were of impractically large size. They are therefore more often combined with a change in direction of the flue gas so that action is assisted by centrifugal force.

A device commonly used on smaller boiler plant consists of a chamber installed as an enlargement of the steel chimney where the rising gases slow down and deposit the grit they are carrying. The separation is assisted by baffles that deflect the gases in a downward direction. The separated dust slides down an inclined plate to a collecting hopper. An efficiency of 70 per cent. can be obtained in this manner.

2. *Scroll Collector*

(*Dust Removing Fan*)

Instead of relying on the vortex generated by admitting the gases via a tangential inlet to a cylindrical chamber as in the cyclone, a fan is used. Often this combines the functions of dust extractor and I.D. Fan. The centrifugal forces concentrate the dust particles in the gas layers at the wall of the volute casing where they are skimmed off and conveyed by a secondary duct to a secondary dust collector, usually a cyclone. The cleaned gases from the cyclone are returned to the core of the fan suction. A boosting fan may be used to provide the necessary driving force to send the bled gases through the secondary collector. There are numerous variants of the principle. These devices are in daily use and work at up to 80 per cent. efficiencies on stoker fired boilers.

3. *Louvred Cone Collector*

The dirty gases are directed into the base of a vertical steel plate cone, the sides of which contain many horizontal slots. In changing direction to pass through the dust burden and are collected and led away to the chimney. The dust laden gas inside the cone is continuously exhausted and taken to a fan assisted cyclone where it is collected for disposal. The " secondary " cleaned gas is then put back into the system at the inlet to the main collector. Efficiencies of 90 per cent. can be achieved.

4. *Cyclones*

All cyclone separators use a gas vortex to impart centrifugal force to the solid particles suspended in the gas. Because of the great difference in mass between solid particles and the gas molecules this force tends to cause the particles to leave the spinning gas stream and reach the wall of the cyclone body where they spiral downwards into the dust hopper. The gas vortex may be set up by tangential entry of the gas or by axial entry through swirl vanes.

5. *High Throughput Cyclone*

For high throughputs, the gas inlet to the cyclone has to be of large dimensions to obtain the cross-section necessary for the large gas volume rate. This in turn means a relatively large cyclone radius and exit pipe dia. All these factors tend to a comparatively low maximum spinning speed and broadly the high throughput cyclone is suitable for separation of coarse particles in a single unit, from high rates of gas flow. Because of its design, it does not provide high separation efficiencies at the lower range of particle sizes. The relatively low gas speeds give it a low pressure loss and efficiencies of 80 per cent. can be obtained.

6. *High Efficiency Cyclone*

For high efficiencies of collection of the small diameter particles the minimum effective radius and therefore the exit gas pipe diameter must be reduced. This means that less gas can be passed through the cyclone but higher efficiencies are obtainable, up to 90 per cent.

The type is characterized by a smaller cross section gas inlet (both shallower and narrower than for the high throughput type) and low ratio of gas outlet pipe to cyclone body dia. (say 0·50).

A single cyclone is often combined with a Scroll type collector.

7. *Multicyclone*

The extent to which gas tangential velocity can be increased is limited and for high efficiencies on small particles the cyclone body diameter must be restricted to a few inches. This of course reduces the gas rate that can be passed through a unit and many units are grouped together in a common casing, to deal with larger gas volumes. Hence the name multicyclone.

In some types the gas enters through tangential slots, in others the entry is axial and the swirl is obtained by inlet vane rings fixed in the annular entrance duct. The gas in all cases leaves by a central exit pipe.

One difficulty with the multicyclone is to obtain satisfactory gas distribution through the many units. The entrance chamber to batteries of collectors is tapered in some makes to assist in even sharing of the gas load. Another potential difficulty in the small diameter cyclones ( 8 in. is a common diameter) is blockage. This has not been found troublesome except on plants using high chlorine coal. The difficulties are tackled by installing soot blowers and a scraper device.

8. *Cellular Type Collectors*

A cellular collector consists of a number of cells working in parallel. In each a vortex is induced by passing the dirty gas through cast iron swirl vanes. The dust is concentrated into the outer annular gas layers and is drawn off by withdrawing a small proportion of the gas through an annular space surrounding the clean gas outlet pipe. The dusty concentrate gas is treated in a secondary system, either by high efficiency or multicyclones and the small volume of cleaned secondary gas is returned to the clean gas inlet of the main I.D. Fan. A boosting fan is used to circulate the gas in the secondary circuit.

The cellular system has many advantages. The cells can be built up in banks and as they are arranged horizontally these banks form a compact installation. By suitable vane design the efficiency of collec-

**Typical Efficiencies of Main Types of Mechanical Collector**

| *Type of Collector* | *Typical Efficiencies (%) Particle Sizes in microns* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 5 | 10 | 15 | 20 | 40 | 60 | 80 | 100 |
| Scroll Type .. .. | 3 | 7 | 11 | 17 | 60 | 90 | 96 | 98 |
| High Capacity Cyclone | 25 | 42 | 56 | 64 | 87 | | | |
| High Eff. Cyclone .. | 60 | 80 | 87 | 92 | 96 | | | |
| Multi-Cyclone .. | 80 | 92 | 97 | 99 | | | | |

tion can be varied. The system has been installed for pre-cleaning of flue gases before electrical precipitation and maximum efficiency is not always called for in the primary unit. It is said to have a remarkably flat average efficiency/load curve and a maximum efficiency of 95 per cent. can be obtained.

9. *Efficiencies of Mechanical Collectors*

The various types of collector have a wide range of efficiencies. Some, as stated earlier, do not have high efficiencies on small particle size. All vary a great deal according to loading and condition of operation as well as design detail, but an attempt is made in the table above to give an idea of what can be expected.

10. *Electrical Precipitation*

The efficiency of removal of the particles at the small end of the size range does not fall off in the electrical precipitator anything like as much as it does in mechanical collectors. Electrical precipitation is therefore widely used in fact almost exclusively used for the separation of fly ash from large P.F. fired boilers at power stations and large factories. Several installations use cyclones or more recently cellular collectors before the precipitator to remove the heavy burden of coarser particles and so avoid some of the difficulties that its deposition on the collecting electrodes can cause.

The principle of operation is simple. The gases pass through an electrical field set up between a wire or plate at high negative electrical potential and an earthed collecting plate or tube. The field causes ionization of the gas passing through it and a small proportion of the ionized gas passes its charge on to the dust particles. The remainder of the gas ions flow to the collecting electrode in the form of a d.c. corona discharge. The charged particles acquire a migration velocity in the direction of the earthed electrode—the " drift velocity " as a result of the voltage gradient in this direction and by balancing this velocity against the velocity already possessed from their presence in the moving gas stream, it is possible to arrange for the dust particles to reach the collecting electrodes before the gases reach the outlet of the precipitator. The collecting dust is removed periodically from the collecting electrodes, usually by rapping.

The original precipitator was the wire in tube type in which the high tension discharge wire electrode was suspended axially in an earthed collecting tubular electrode, arranged vertically. This is still one of the main types used in flue dust precipitation, but the tubes are usually made hexagonal and formed into a nest to save ground space.

The other main type is the plate type in which the wire discharge electrodes are suspended equidistantly between the earthed plate collecting electrodes. In flue gas precipitation the gas travels horizontally through the spaces between the electrodes.

The discharge electrodes are raised to a negative high tension potential, usually of the order of 50/60,000 volts. The electrical equipment to supply this potential consists of a transformer to step up the grid a.c. voltage and a

**Typical Costs of Mechanical Collectors and Electrical Precipitation**

| *Type of Collector* | *Capital Costs* | | *Total running costs pence/1,000 cu. ft.* | *Total cost pence/1,000 cu. ft.* |
|---|---|---|---|---|
| | *£/cu. ft./min. capacity* | *Pence 1,000 cu. ft.* | | |
| High capacity cyclone.. | 0·05 | 0·002 | 0·013 | 0·015 |
| High Eff. Cyclone .. | 0·10 | 0·004 | 0·018 | 0·022 |
| Multicyclone .. .. | 0·20 | 0·009 | 0·016 | 0·025 |
| Electrical Precipitator.. | 0·70 | 0·030 | 0·007 | 0·037 |

rectifier to convert the H.T. a.c. to d.c., together with the necessary surge resistances, condensers, protection and regulation equipment.

### Costs of Dust Collection

It is difficult to state costs of the various systems, because of the wide variations in design, duty and working conditions. However, an attempt has been made in the following table to give the relative order of capital and running costs of the main groups of mechanical collectors and electrical precipitators. The latter are comparatively very expensive to install and are therefore mainly restricted to central generating stations and large industrial boiler plants burning pulverized fuel. Only in these cases does the flue dust contain a sufficient proportion of the smaller particles to warrant the use of electrical precipitators.

The following are also recent typical examples of costs of plant for a boiler of evaporative capacity of 6,000 lb./hr.

(1) *Baffle type* (65 per cent. efficiency)

In vertical flue pipe—£450–£500.

(2) *Single Cyclone* (85 per cent. efficiency)

Complete with fan and ducting—£1,000–£1,200.

(3) *Multicellular*

Complete with additional I.D. fan—£1,800–£2,000.

### Spark and Grit Arrestors for Cupola Furnaces

The problem is governed by two main conditions:

1. High temperature of operation.
2. Low draught loss required.

The simplest and most effective method of achieving reasonable abatement of spark and grit emission is to install a collector of the baffle and settling type in the main flue pipe with the addition of water sprays. The gases are subjected to a reduction in velocity and change in direction before being passed through a fine water spray which both extinguishes the sparks and cools the collector. The water is drained off containing the collected grits and disposed of.

### Prevention

Remember that prevention is always better than cure. Dust and grit emissions which cause nuisance can often be caused by bad operation of the plants in question. The importance of even firebeds, the correct draught and regular flue cleaning cannot be too highly stressed.

*The third of the Leeds conference papers mentioned on page* 288, "*Smoke Production and Prevention*," *by H. Pollard, has had to be held over until our next issue.*—ED.

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The Central Electricity Generating Board are to apply to the Minister of Power and the local planning authority for consent to the establishment of a second nuclear power station at Hinkley Point. The "A" station is expected to start operation in 1963, and the new station, "B," if authorized, would probably start construction in 1965 and be commissioned in 1969. It is proposed that the new station will have a sent-out capacity of about 1,000MW.

# *Debate on Diesel Smoke*

## The Speir Bill Withdrawn

*On April 6th the House of Commons held a debate on the second reading of the Diesel Fumes Bill introduced, as a Private Member's Bill, by Mr. Rupert Speir, M.P. We publish some of the points made during what was a most interesting debate, omitting for reasons of space much that we should like to have included. The Bill was criticized on a number of grounds and at the end was withdrawn by its sponsor. Although the Society, which earlier had had an opportunity of making its observations on the Bill, had also criticized some of its clauses, we would wish to add our own tribute to those made in the House to Mr. Speir for his public-spirited action in seeking to follow up the success of his valuable Litter Act.*

**Mr. Rupert Speir** (Hexham): I beg to move, That the Bill be now read a Second time.

The simple object of this Bill is to discourage lorries and other road vehicles from belching out dark diese smoke. In short, I have the same object in mind in sponsoring this Bill as I had when I sponsored the Litter Act and the Noise Abatement Act, namely, in some small way to help to make Britain a cleaner, tidier, more peaceful and pleasant place in which to live. We are all fortunate enough to live in a lovely country, and we ought to make some effort to keep our country lovely.

I realise only too well that in tackling this subject and in trying to introduce some measure of control and to abate diesel fumes I am dealing with a much more difficult subject than that of litter, and, indeed, a much more complex subject than even that of noise. Diesel fumes may well prove my Waterloo.

At any rate, I may have some consolation in the fact that my campaign has had one result, namely, that British Railways have taken to using additives in the fuels used by their diesels at Waterloo Station, and I am told that these additives to the fuel are proving very effective and have removed many complaints.

I do not base the desirability for the Bill becoming law on the fact that dark diesel fumes may be injurious to health. I base the need for the Bill on the fact that dark diesel fumes are unnecessary and unpleasant. They are also dangerous to road traffic, because their oily deposits cause skidding on the highway and their black smoke often destroys visibility and encourages drivers to overtake when it is not safe to do so.

In my view, a further step should be taken to avert diesel smoke from road vehicles on the ground that it is undesirable. More and more vehicles are coming on to the roads of Britain every year. I believe that about half a million additional vehicles come on to the roads every year. With the number of diesel vehicles continuing to increase—they have increased by 400 per cent. in the last ten years, with the numbers rising from 88,000 diesels in 1950 to 374,000 diesels in 1960—the problem is becoming ever more important.

Diesel smoke is unburned fuel. It is like going round with a hole in one's fuel tank. It is absurd that the law should encourage such a ridiculous and dirty habit, and we in Parliament should outlaw the lorry lout in the same way as Parliament acted to outlaw the litter lout.

The road hauliers themselves accept that there is far too much variation in the standard of fuel oil in this country. There is a difference in standard between the fuel oil of one manufacture and that of another, and, indeed, there is a difference in the standard of fuel oil provided by the same manufacturer in different parts

of Britain. It is not unreasonable, therefore, to ask the Minister to consider laying down a general standard for diesel engine fuel. I do not think I have left in the Bill Clause 6, which provides for the use of vertical exhausts on heavy goods vehicles. I have done this with certain misgivings because I believe that, on balance, and only on balance, especially in urban areas where lorries and buses are often stationary in queues for a long time, it is better for the exhaust fumes to be emitted near ground level rather than sprayed over the heads of passers-by or directed, as they might be, from vertical exhausts into first-floor or ground windows.

The Motor Vehicles (Construction and Use) Regulations should be amended and strengthened so that people would not be allowed to use vehicles on the road if they caused annoyance to other road users. That is different from the present formula under which vehicles may be used unless they cause danger or damage to property. That is obviously something which it is difficult for the police to prove.

**Mr. R. Gresham Cooke** (Twickenham): I am sure that we all want to congratulate my hon. Friend the Member for Hexham (Mr. Speir) on his initiative in bringing forward the Bill. He has had a considerable measure of success with other Bills touching on litter and noise, and now he wants to add fumes to his bag. Those are the sort of subjects with which hon. Members should concern themselves on Fridays. I was sorry to read in the Press recently that my hon. Friend may be giving up Parliamentary life at the end of this Parliament. We shall miss his contributions very much.

I agree with his aim of abating the diesel fume nuisance and more than once I have suggested to Ministers that we should add the words, " nuisance or annoyance," which are mentioned in the Bill to the words, " danger, damage and injury " which are contained in the present Motor Vehicles (Construction and Use) Regulations. If we added those words, it would be easier for the police to prosecute and simpler to apply the Regulations and the law would be strengthened. I have never understood why the Home Secretary has resisted recommending that addition to the law in the Metropolitan Police District, because I have been told by individual policemen that it would help them to have these words added to the Regulations.

Clause 1 (1) requires the use of additives to fuel, but I have always been doubtful about the value of additives. My opinion has been reinforced by a letter which I have had from Dr. Fogg, who is known to some hon. Members and who is the Director of the Motor Industry Research Association and who has done a good deal of research into this subject. He is impartially employed by the petrol firms as well as by the motor manufacturers. He says:

" Furthermore, in spite of the claims made by certain firms selling diesel additives, we do not accept they they will provide a solution, or even substantial mitigation, of the nuisance of diesel smoke."

Smoke should be nipped in the bud at the source by prescribing an acceptable ratio of engine power for manufacturer's gross vehicle weight. In short, smoke very often comes from under-powered vehicles, overloaded vehicles.

I think I would agree with my hon. Friend that we should want a British Standards Institution definition of diesel fuel, which we have not got. Then again, components of some diesel engines are not up to a satisfactory standard.

**Mr. G. A. Pargiter** (Southall): We are all familiar with the oil deposits on the surface of the road which we increasingly see nowadays.

With the spread of diesel vehicles, these have become so much a hazard to be expected that one can almost argue that a motorist ought so to drive that when he is overtaking another vehicle he should examine the road surface ahead of him to see whether

he would be going over patches of oil.

These oil deposits come from diesel vehicles. I am not an expert and I do not know how they come, whether it is from fumes or from drippings. It must be something to do with the maintenance of diesel vehicles.

**Mr. Ronald Bell** (Buckinghamshire, South): I hope that we will start by clamping down on diesel engines and then gradually and progressively squeeze out all internal combustion engines from our towns and cities.

**Mr. Gresham Cooke:** Back to the horse and cart!

**Mr. Bell:** No. The development of the electric battery vehicle is obviously the right line of progress. I am amazed that it has not been pursued farther. It would be pursued, if we passed legislation prematurely and suspended its operation. We would then have an astonishing development in electrically-propelled vehicles. That is all we need to do.

What folly it was to abolish trolley buses and replace them with diesel buses at this stage of civilization.

**Mr. John Wells** (Maidstone): I would remind my hon. Friend that in my constituency the trolley bus is on the advance and is by no means being replaced. We have a municipal undertaking which makes a profit on its transport.

**Mr. Bell:** I am glad that I gave way to my hon. Friend. That is the kind of interruption I like. It makes sound common sense.

**Mr. Ronald Russell** (Wembley, South): My hon. Friend the Member for Twickenham (Mr. Gresham Cooke) tells me that vehicle manufacturers are willing to fix a plate to the side of vehicles stating the maximum load which the vehicle should carry in relation to the power of the engine. This would be of great advantage in enabling the police to detect whether overloading was the cause of the emission of black smoke, and not lack of maintenance. I hope that my hon. Friend the Parliamentary Secretary will consider this point.

**Mr. John Wells:** It is in the interests of every proprietor of a diesel vehicle to see that his maintenance is of such an order that his vehicles do not emit smoke. It is extraordinary that it should appear at first sight to be necessary to legislate to force a tough section of our business community to run their businesses properly, because that is exactly what it amounts to. Bus and haulage operators are shrewd business people. It is extraordinary that we in the House have to instruct them in the first principles of running their affairs.

However, my hon. Friend the Member for Hexham used the phrase, " a hole in one's fuel tank." In whose interests is it that black smoke should be emitted? The owners do not want it. Who, then?

**Dr. Alan Glyn** (Clapham): I am sure that we are all worried about the diesel fumes in the atmosphere, but I think that it is right to divide the problem into two spheres. First, there is the danger to health—what I call the medical attitude—and, secondly, and much more important, there is the danger to road users, which has been mentioned.

One has to consider how one can check the various vehicles. One has to find some efficient method of checking them, and then one needs a foolproof system whereby offenders can be successfully prosecuted. I think that this is an important side of it, because it is no use having a large number of prosecutions if they are not successful. I hope that my hon. Friend the Parliamentary Secretary will give us not only the figures of the number of people prosecuted but also the number who were successfully prosecuted.

There is no doubt that unpleasant fumes are emitted by a large number of vehicles on the roads not only in cities but in the country. Nevertheless, I think that it would be wrong if it went out from this House that it was a serious greater danger to the health of our people. I do not wish to minimize the danger, but I should like the House

to keep a sense of proportion about it. We are overshadowed at the moment by this question of lung cancer and I think that it would be wrong to link this danger with the cigarette danger which is so serious to the public.

I agreed with my hon. Friend the Member for Wembley, South (Mr. Russell) who said that the number of diesel engines was increasing and that the number of coal fires was decreasing, but I think that again one has to get this into perspective. The amount of fumes emitted either by power stations or by homes is so enormous in comparison with that emitted by diesel engines that we can probably ignore that aspect completely. I agree that it is a danger, but it is a small one, and even if we were to make all zones smokeless the difference would be very small.

It may well be, as my hon. Friend said, that other factors in the fumes will be proved to be carcinogenic. I think that most hon. Members agree that a rough and ready definition of carcinogenic material is something which is an irritant. Of course, there are degrees of irritants, and I do not think that this is regarded as a particularly noxious one. I say this because I think that there is a tendency in the public mind to be alarmed by this factor. I believe that the present medical evidence indicates that the alarm is, perhaps, exaggerated.

**The Parliamentary Secretary to the Ministry of Transport (Mr. John Hay):** If I may take up a point mentioned by the hon. Member for Manchester, Openshaw (Mr. W. R. Williams), the information that I have as a result of the researches of the Medical Research Council is that these investigations have not shown any specific threat from diesel fumes alone in the concentration in which they are found in our streets. Diesel engines, as hon. Members have said, emit mainly water vapour and carbon dioxide, but mixed with them is a certain amount of hydrocarbons and carbon particles, the proportion depending on how well maintained the engine is.

The emission of such potential cancer causing substances as 3:4 benzpyrene are small even in the worst of conditions. Already these results have begun to draw attention to what may be a real problem. As all other forms of air pollution decrease through the spreading of smokeless zones in the country so the contribution that vehicle exhausts make to the atmospheric pollution will rise as a proportion of the whole pollution, even if the total contribution can be held down. It is the petrol engine exhausts which are likely then to be the main hazards. Petrol engine exhausts contain large quantities of carbon monoxide as well as certain hydrocarbons, lead and oxides of nitrogen.

We are watching the results of research work in the United States on petrol exhausts. The problem is far more acute there, particularly in the Los Angeles Air Pollution Control District, than it is in this country. My hon. Friend the Member for Buckinghamshire, South (Mr. Ronald Bell) mentioned this in the course of his speech. If it proves possible to implement the California law on exhaust emission we shall study the results with great interest.

Secondly, in reviewing what has been done, I want to say a word on what has taken place in reducing diesel smoke. Extensive tests have been carried out by the Department of Scientific and Industrial Research, and these have proved that a well maintained and properly driven diesel-engined vehicle does not normally emit any more than the slight puff of smoke which has been referred to in the debate. Tests have also been made by the Department of a number of fuel additives—substances added to diesel fuel—and of various filter devices which are supposed to be effective in reducing or removing dark smoke.

All these tests have proved abortive. It seems clear that neither the fuel additives nor the filter devices are as fruitful a field for the reduction of dark smoke as is the much more mundane but useful method of ensuring the

proper maintenance and adjustment of the engine.

I now turn to the question of the existing law. It is contained in the Motor Vehicles (Construction and Use) Regulations, 1955, which have been amended in this respect on two occasions—once in 1957 and again last year. The existing law does two things—first, it requires that all vehicles should be so constructed as not to emit avoidable smoke and, secondly, it forbids the use of vehicles making smoke which is likely to cause danger, damage or injury to anyone on the road. I ask hon. Members to bear those three things in mind—damage, danger or injury.

This law has recently been strengthened by the new Regulation to which my hon. Friend the Member for Buckinghamshire, South referred, which, as from January 1 last, forbids the misuse by the driver of a diesel-engined vehicle of the excess fuel device, which, in certain circumstances, can provide extra power at the cost of black smoke. The Regulation also requires the control for the device, on new vehicles, as from January 1 to be such that it cannot be operated when the vehicle is moving. Older vehicles have to be modified in this respect by July 1 next.

Since this is not yet fully in force I cannot tell what the result may be, but we think that it will have some effect in reducing the outpouring of black smoke on hills. It has the great advantage that it will allow for much easier enforcement, since either the device, if used, will still be operating when the vehicle is stopped, or it will be found in a position where it can be operated from the cab. Both these things will be offences.

I want to say a few words about the enforcement of the existing law. The police and the technical officers of my Department have both devoted a great deal of attention to the problem. In the course of the debate figures have been quoted of the number of prosecutions. My information is that in 1960–61 there were 1,875 prosecutions. I am afraid that I cannot tell the House how many were successful and how many failed, or what the further results are—certainly not in the time available to me today.

Under Sections 133 and 184 of the Road Traffic Act, 1960, inspecting officers of my right hon. Friend's Department have the power to stop the use of buses and goods vehicles unless and until they are repaired to the satisfaction of the examiner. These powers are widely used. But in spite of all that has been done we know that far too many diesel-engined vehicles make dark smoke, and any means of reducing it will be welcome.

In spite of what has been and is being done, there is absolutely no ground for complacency. Much thought has been given to what further action could effectively be taken. Basically the problem is one of enforcement and, as I will demonstrate before sitting down, our legal powers are reasonably adequate to deal with the problem. What is difficult is to ensure that the enforcement of those powers is much better than it can be in present circumstances.

There are a number of ideas which we have been following up. We are trying to find a procedure for measuring at the roadside the amount of smoke emitted. We are trying to find a method which will give really satisfactory evidence of the degree of smoke emission. As I said during the Adjournment debate in 1960—it has been quoted today—what we want is some kind of device which can be on the roadside pointing at the vehicle emitting dark smoke, and which would give a reading in a permanent form which might be used in evidence.

On the face of it, this may sound a simple thing, but it is not. A number of devices have been under examination. The Warren Spring Laboratory of the Department of Scientific and Industrial Research and the Motor Industry Research Association have joined in this kind of investigation and are continuing with their examinations. Recently they have been looking at two existing meters, the Hartridge

B.P. and the Bosch which are being manufactured in this country by the Dunedin Engineering Company. Neither has proved wholly satisfactory for our purposes. If we can find a suitable procedure, the density limit which is referred to in Clause 1 (2) of the Bill will replace the present more general Construction and Use Regulations under Section 64 of the Road Traffic Act, 1960. If that is not likely to be possible in the near future, nuisance and annoyance can be added to the existing criteria of vehicle smoke emission which I would remind the House are damage, injury and danger.

At one time the police took the view that to make such a change would hinder rather than help the enforcement of the law. Now they have come round to a point of view where they are more in favour of it. So if the current work on emission does not suggest that we shall be able to fix a definite smoke limit in the near future, we will undertake the necessary statutory consultations with a view to supplementing the existing Regulations by adding nuisance and annoyance to the present criteria. Already we have the powers to do this by Statutory Instrument made under Section 64 of the Road Traffic Act, 1960. At the same time the enforcement staff of my Department are giving what attention they can to the subject. As a result of recent discussions with the National Society for Clean Air ways of strengthening this work and using propaganda to draw the attention of operators to the matter are under consideration.

I should like particularly to mention that we are making arrangements for simultaneous checks to be made throughout the country on the same day, as part of our drive against vehicles with smoky exhausts. Checks will be made on stretches of road which carry a lot of heavy traffic and where there is a suitable hill which is known to cause vehicles to emit smoke. At least one checkpoint in most counties will be arranged. Where the local police are willing to bring prosecutions for excessive smoke emissions, their assistance will be sought. In areas where they are unwilling to bring prosecutions we shall have to take other action such as issuing a notice of prohibition of use of a vehicle to carry goods, or send a letter to the owner of the vehicle and follow that up with visits by our vehicle examiners. We have in mind to repeat the whole of this check on two further occasions at about monthly intervals.

**Mr. W. R. Williams:** Will those checks be carried out in built-up areas as well as in open country?

**Mr. Hay:** I am not going to tell the hon. Gentleman, for this reason—we do not want to disclose too openly exactly where these checks will take place.

**Mr. W. R. Williams:** I am not asking that.

**Mr. Hay:** I realise that, but perhaps the hon. Gentleman will understand my problem. I have announced that we are to have these checks, and that they will be pretty widespread throughout the country. I am not going to be more specific than that, and I hope that the hon. Gentleman will understand why. As I have said, we have wide powers stemming from Section 64 of the Road Traffic Act to deal with this problem. The Bill does not give us very much more than we have now.

Clause 1 would give the Minister power to prescribe densities of smoke and visible vapour, and to prescribe that additives must be used in all diesel engines. Already under Section 64 we have powers wide enough to do these things.

Clause 2 would apply to the offence of emitting smoke above the specified density the maximum penalties which are at present applied to breaches of the Construction and Use Regulations. In the Road Traffic Bill at present before the House, the distinction in fines is being wiped out. We are having a flat maximum penalty of £50 for each offence, and we should not therefore want to introduce a penalty for one

offence alone which was out of line with all the rest under that particular section. So, for that reason, I should not welcome Clause 2.

Clause 3, however, would be a welcome addition to the Minister's power. It would mean that if and when reliable roadside measurement was possible those diesel-engined vehicles which were not already subject to special provisions about inspection by vehicle examiners—and these are mainly taxis and buses, used, for example, by contractors and not as public service vehicles—could be tested at the roadside. I suggest to my hon. Friend that, in any event, whatever happens to this Bill, he should propose an Amendment to the Road Traffic Bill with the effect of Clause 3, and we should be happy to incorporate it in that Bill.

Clause 4 simply duplicates what would be the position under Section 68 of the Road Traffic Act, if and when it is proved possible to set specific minimum figures for smoke density, and I do not think that we should pass duplicating legislation.

Much as I admire the idea behind Clause 5, unfortunately it will not work, for reasons which have been mentioned by hon. Members. The vehicle testing scheme is not designed to deal with these large lorries and buses with diesel engines.

Clause 6 has already come under heavy fire from a number of hon. Members who do not think that there is much point in having a vertical exhaust if all that happens is that the smoke and perhaps the sludge which collects in the exhaust pipe is spread out over the heads of passers-by and into windows rather than directed downwards on to the ground.

In all the circumstances, while I welcome my hon. Friend's initiative, I hope that perhaps he will consider that it is not much use proceeding further with this Bill in the light of the assurances and undertakings that I have given. I therefore invite him to suggest to the House that perhaps the Bill might be withdrawn. We have not wasted our time today, and I am grateful to my hon. Friend and to the House for the full and frank discussion that we have had of this difficult social problem.

**Mr. Speir:** I do not wish to detain the House, but if, with the leave of the House, I might speak again, I thank hon. Members and the Minister for the care that they have given to this Bill. I realise that it has certain weaknesses and imperfections. It is like the curate's egg, good in parts. As I understand it, the Government will accept the good parts.

Therefore, on that assurance, I beg to ask leave to withdraw the Bill.

*Motion, by leave, withdrawn.*

*Bill withdrawn.*

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# DIESEL SMOKE

## *A Report and a Survey*

The Vehicle Exhaust Study Group of the Institute of Road Transport Engineers has published a First Interim Report which is published in the Journal and Proceedings of the Institute (March, 1962, 15, 134-137). Following are the conclusions and recommendations of the Group:

" At this intermediate stage of its investigations, the Group has formulated the following conclusions and recommendations.

(1) Diesel exhaust smoke is unpleasant and criticism of it is justified.

(2) Many factors contribute to the emission of exhaust smoke but they are seldom rationally considered when the subject is being publicly discussed, *e.g.*, in Parliament or in the national and technical press.

(3) Given suitable facilities, the fleet engineer could limit the emission of smoke to the minimum.

(4) If operators do not themselves overcome the problem, more stringent legislation is likely to be introduced. In this event, the Group believes it is expressing a majority view in advocating consideration in terms of an acceptable ratio of engine power to

gross vehicle weight rather than in terms of smoke density control.

(5) Smokemeters might be used to supplement a power/weight control but only as a deterrent and not for determining a legal limit for smoke density.

(6) The Group is circulating this and subsequent Reports of its investigations to other interested organizations and recommends that steps should be taken at a suitably high level to establish a National Panel representing all organizations interested in overcoming the problem of exhaust fume emission from road vehicles in Great Britain."

*A Survey*

The weekly journal *Motor Transport* published, on April 27, 1962, a comprehensive and meritorious survey of " Black Smoke " as a 12-page supplement. One of the articles from this we publish, by kind permission of the Editor, on page 305. Another valuable feature of the survey was a " smoke diagnosis chart ", in which in tabular form were given the symptoms, the probable diagnosis, the cure, together with a column for remarks, of the emission of smoke according to its colour. Other articles were on " Black Smoke and the Law ", which includes a useful symposium on what makers have done to comply with the law, and on " Maintaining a Clear Exhaust," with information on equipment that can be bought.

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**Diesel Smoke Prosecutions**

Recent prosecutions for the emission of excessive smoke from diesel driven vehicles have ranged from Scotland to Lancashire and Bristol. At Rochdale, both the owner and the driver of a motor tanker were fined £5. The driver of a lorry was fined £5 at Chippenham, Wiltshire and the owner £20 for permitting a vehicle to be used which emitted smoke which could have been prevented by taking reasonable steps, whilst for a similar offence at Carnoustie, in Scotland, the driver was fined £1 and the owners £8.

**E.D.A. Handbook**

The Electrical Development Association (2 Savoy Hill, London, W.C.2) has produced an attractive and informative 96 page handbook entitled " At Home with Electricity ". It covers the whole field of electric usage in the home and will be invaluable to all who are interested in a practical way with making the best use of their supply. The text is written in the form of descriptive articles by Eric Ambrose, Joan Storey and Roger Smithells.

**New G.W.B. Boiler on Show in Germany**

Following the successful home market launching of their Vekos Powermaster solid fuel fired boilers late last year, G.W.B. Furnaces Limited of Dudley, Worcs., exhibited one of these new boilers in Germany recently.

G.W.B. technicians have carried out considerable research and exhaustive trials in the development of Vekos Powermaster packaged boilers which conform in all respects to the requirements of the Clean Air Act and are said to give a consistent efficiency of more than 80 per cent. (Gross C.V.) which can be achieved without the aid of economizers or superheaters.

The boiler, Model 100, is capable of raising 3,400 lb./steam/hour F. & A. 212°F. It can be quickly and easily converted for oil or gas firing and conforms to F.B.I. recommendations that the flue dust pollution should not exceed 0·3 grains per cubic foot. This is achieved by built-in grit arresters with a unique system of re-firing the collected grit.

**Belfast Pollution Report**

Six recording stations in Belfast, Northern Ireland, showed that the average deposits of pollutants per square mile per month during 1961 amounted to 20·29 tons. But the Belfast Health Committee reports that in one of the worst areas of the city during the winter, up to 40 tons of polluting material per square mile per month had been recorded. In the best area in mid-summer, it was around 12 tons.

Deaths from lung cancer in Belfast are double those in rural areas in relation to population.

# *Diesel Smoke and its Causes*

## by

## John M. Dickson-Simpson

*Reprinted, by kind permission, from the "Black Smoke Supplement" of "Motor Transport," 27 April, 1962 (see facing page)*

BLACK smoke occurs when carbon particles are suspended in the exhaust from a diesel engine. And carbon results when there has been a shortage of oxygen in the combustion process.

It is not generally realized that the amount of carbon to produce a visible exhaust is extremely small. In fact exhaust usually classed as "just visible" contains only 4 milligrams of carbon per cu. ft. of gas. A moderately black, though just acceptable exhaust contains only 18 milligrams per cu. ft.

These weights represent only 0·2 per cent. and 1 per cent. of the fuel being burned. So it does not take much deterioration in combustion conditions to cause smoke.

Quite simply black smoke is caused by incomplete combustion in the engine's cylinders. Combustion will not be complete if the fuel is of poor quality, if the fuel is not broken into a fine enough spray, if there is insufficient air to burn all the fuel, or if there is too much fuel for the air available (not quite the same thing). Knowing these basic causes, you can then reason out what is wrong with an engine.

### Fuel Quality

Of course, there may be other factors going against complete exhaust. Although these in themselves might have only a marginal effect, they can in some cases be accumulative, so that the total effect is to give quite noticeable discolouration of the exhaust. One of these factors which has a comparatively small effect is the quality of fuel which is used.

As far as fuels go, the factors which affect smoke are volatility (measured by the flash-point temperature), the cetane number (the measure of ignition quality) and specific gravity (the heaviness for a given volume—a number always relative to water, which has a specific gravity of 1). The specific gravity also indirectly gives an indication of the calorific value of a fuel—in other words, the amount of energy it packs.

Volatility has the biggest single effect on smoke as far as fuels go. The more volatile a fuel is the easier it vaporizes. For example, petrol is a lot more volatile than diesel fuel. Consequently, if you run a diesel engine on petrol you can increase the fuel delivery greatly without making the exhaust smoky.

Unfortunately, petrol has a lower calorific value than fuel oil and its cetane index is also low. So therefore more of it is needed to give equal power. By the same reasoning the light fuel oils and petrol-derv mixtures are less likely to make an engine smoke than heavy fuel.

But power depends on the weight of fuel delivered to the cylinders, not the volume. And fuel pumps are calibrated on volume of delivery. Therefore, if you use a heavy fuel (with a high specific gravity) you can get more power out of an engine and better fuel consumption—but more smoke.

### Additives

If you derate the engine to its original power, the fuel consumption will be even better and the smoke limit brought down to normal again. Such savings are marginal, however, because

the extremes of specific gravities of fuel oils are generally 0·835 to 0·86. So not more than about 3 per cent. difference in fuel consumption or improvement in smoke density can be expected.

An increase in cetane number of the fuel oils used will reduce smoke slightly, because the higher the cetane number the readier and therefore more complete is the combustion. Cetane number improvement can be obtained by the addition of between 0·5 and 1 per cent. isopropyl nitrate or amyl nitrate to the fuel oil, but the effect is small and cannot cure dense smoke.

Such additives do, however, enable the more economical heavy fuels to be used without causing more smoke, and they usually result in smoother combustion and perhaps less noise.

Other additives, such as Vigzol and Redex, contain a deodorant, and this has quite a beneficial effect from the point of view of the public, even if it does not reduce the visible density of smoke. This is because a deodorant can mask the smell of fuel oil, which makes diesel engines so much more noticeable to the general public.

The smell comes from constituents called aldehydes, and in extreme cases these can also cause eye irritation. They are invisible and can be associated with blue as well as black smoke.

But aldehydes are more readily produced by idling or decelerating petrol engines than by diesels, even though diesels tend to generate aldehydes all the time. For this reason irritating concentrations of either aldehydes or carbon monoxides in a town where there are traffic jams is more likely to occur with petrol than with diesel engines.

Overall fuel quality does not have a large bearing on exhaust smoke. If it is poor, it usually means merely that if the exhaust was clear before, there will be a visible trace after the use of heavier fuel.

Nevertheless, the fuel suppliers themselves do not give the operator much chance of selecting his fuel on its technical merit. In reply to a letter written by *Motor Transport* to all the British fuel suppliers, only three of them gave a satisfactory answer. The suppliers were asked to give details of their fuel's quality. It would be of great value to operators to know the flash point, cetane number, specific gravity, and sulphur content of fuels. Also, if a fuel contains any special additives which would help to improve the cetane number or reduce the incidence of black smoke by a small amount, then it would be in the operators' interest to know about it.

Only the Cleveland Petroleum Co. Ltd. and the British Viscoleum Fuels Ltd. would reveal the specification of their fuels to operators. The Mobil Oil Co. said that its diesel fuel met the requirements of British Standards Specification 2869 Class A, which was issued in 1957.

From *Motor Transport's* investigations it is apparent that the biggest single cause of black smoke is maladjustment of the fuel injection system. This usually arises from adjustments to the governor setting or maximum fuel-stop setting to obtain more power from an engine.

**No. 2 Big Cause**

The second biggest cause of smoke is deterioration of the fuel-injection system. Third in order of blame comes general mechanical deterioration of an engine and choked breathing. And rarest of all is misuse of the excess fuel device by drivers to obtain more power.

Two types of checks have revealed the distribution of blame for black smoke. In an example of the first type, an examination of the worst smoking vehicles in a fleet revealed that only 30 per cent could be cured by maintenance of the fuel-injection equipment. An instance of the other type was a complete clinical check on a fleet, which resulted not only in a general decrease in smoke but also in an overall improvement in fuel consumption of 3 per cent.

More often responsible than the physical condition of fuel injection equipment is the adjustment of the maximum fuel setting and the injection

timing. Bad smoking will occur if even only 1 per cent. of the injected fuel is not burned.

So if a little too much fuel is injected or it is injected at the wrong time, a diesel is liable to smoke. Naturally, some engines can sustain tampering with the fuel-injection settings better than others.

The power output quoted by most diesel engine manufacturers correspond to the fuel injection setting at which exhaust smoke is just visible.

Of the diesel-engined vehicles which have been tested by *Motor Transport* recently only two makes of engine have had perfectly clear exhausts at all times, and these have been the Gardners and the new Power Plus series of Leyland engines. A.E.C. engines generally have a clear exhaust until they are run beyond 2,000 r.p.m. when the breathing capacity is exceeded.

With all the new engines the amount of smoke is certainly slight, and is considered to be well within tolerable limits. But it does mean that the operator has less leeway in which to work before he runs into difficulty with smoke which is more dense.

The temptation to obtain more power from engines is very real and quite often fuel settings are altered deliberately. This is why there is now a fairly general demand for more powerful vehicles, and why some operators have been experimenting with turbo-chargers in order to obtain more power without increasing smoke, and usually without spoiling fuel consumption too much either

The lower significance of fuel costs compared with total running costs now encourages operators to accept more powerful engines more quickly. Indeed, in many cases where more powerful engines have been used fuel consumption has actually improved.

Overloading is often blamed for causing black smoke. But in fact overloading in itself does not produce an increase in smoke density; it is the extra temptation to adjust maximum fuel settings which arises from overloading.

The desire for more power has grown more acute in the last few years as a result of the swing to light vehicles for carrying the maximum payload within the legal limits.

A mass-produced 7-tonner might have a perfectly acceptable power-to-weight ratio in its normal four-wheeled form. But its power-to-weight ratio deteriorates considerably if it is converted into a six-wheeler, rated at 10 tons payload and quite often carrying 14 tons in practice. The same applies if it is used in the form of a tractive unit forming part of an articulated vehicle.

Of course, an overloaded vehicle does tend to deteriorate quicker, because its engine is working so much harder. But deterioration of general mechanical condition is in practice only a secondary cause of black smoke, compared with ordinary deterioration of the fuel-injection system.

**The Real Culprits**

Where ordinary deterioration rather than simply maladjustment is the

**QUALITIES OF THREE FUEL OILS**

| Quality indications | **British Viscoleum** | **Cleveland** | | **Mobil** |
|---|---|---|---|---|
| | | High-sulphur | Low-sulphur | Class A |
| Flash point | 170 deg. F. | over 180 deg. F. | over 160 deg. F. | 130 deg. F. (min) |
| Cetane number | 47 | 58 | 52 | 45 (min) |
| Specific gravity | ·842/·845 | ·833 | ·842 | |
| Sulphur content | ·07 max | ·95 | ·28 | 1·3 (max) |

cause of smoke, injectors and delivery valves are the biggest culprits. Quite often smoke is simply a result of a low-pressure setting of an injector.

A drop of 10 atmospheres in the setting of an injector is not so bad, but a drop of 15 atmospheres will cause the exhaust smoke to be visible. Bad smoke will result if the injector pressure is allowed to deteriorate by 20 atmospheres. One atmosphere equals 14·7 lb/sq. in.

It is quite a good idea to set the pressure of reconditioned injectors 5 atmospheres up in order to allow for the nozzle seat bedding. Moreover, after reconditioned injectors have been fitted it is as well to check the pressures after 5,000 miles. With such equipment as the Dunedin gauges now available, such checks can now be done without the injectors having to be removed from the engine.

Sometimes the cause of black smoke can seem elusive. For example, if an injector is clamped down too tightly the nozzle seating can become distorted and so fuel is liable to dribble past the seating, causing a lot of unburned fue in the combustion system. One engine which has been particularly susceptible to the clamping pressure exerted on its injectors is the Leyland Comet.

The basic point to watch on fuel systems is cleanliness. If a fuel system is kept clean and the filters serviced regularly, an operator can usually keep out of trouble on smoke longer than if he simply changes filters when it looks as though the fuel is having difficulty in reaching the pump. It needs only a speck of dirt in the delivery valve to cause smoking from a cylinder.

It should also be remembered that if the delivery valve is changed on the engine there can be great risk of even more dirt getting in the fuel system. That is, unless precautions have been taken to wash down and dry the exterior of the pump and adjacent parts thoroughly before working on it.

Apart from smoke occurring as a result of too much fuel being injected, or fuel being injected at the wrong time because of misplaced timing, or because fuel is leaking past the injectors, combustion will not be complete if the breathing of an engine is restricted too.

This is usually due to dirty air filters, and if the filter is of the paper-element type operators should be especially wary. Paper elements are so efficient that they tend to clog more quickly, and the clogging is made more acute in this country because of the humid climatic conditions.

As an engine gets older its ports and valves tend to become coated with soot and sludge, and this again reduces the breathing capacity of the engine and makes it more prone to black smoke.

Governors can affect black smoke, but they are not big offenders. The most prone to trouble is the pneumatic type, because sometimes the diaphragm leaks. But if the maximum fuel stops are adjusted correctly this should not result in over-fuelling in any case.

The most trouble-free governor as far as smoke is concerned is the hydraulic type, but it is also the most expensive. There is a growing tendency to steer a middle course on cost and equip newer engines with mechanical governors.

On distributor pumps the only real source of malfunctioning is wear of the impeller of the transfer pump within the body. Its efficiency can be checked by noting the delivery pressure.

No delivery valves are fitted at the outlets (although Bosch claim they are an improvement) and there is very little difference in output between the elements. Sometimes, if there is a slight difference, it can be compensated by adjusting the injector opening pressure.

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**New Chief for N.I.F.E.S.**

The Board of the National Industrial Fuel Efficiency Service announce the appointment of Mr. S. C. Ginn as Chief Executive in succession to the late Dr. Angus Macfarlane, C.B.E. Mr. Ginn has been Commercial Manager since 1956.

# AIR POLLUTION ABSTRACTS

**591. Corrosion Problems Affecting Boiler Plant and their Treatment as a Contribution towards the Clean Air Act Requirements.** Lock, A. E., Institution of Plant Engineers, Blackburn. Many earlier theories claimed that the external fouling and corrosion problems affecting boiler plant, were related to the amounts of one or more of the constituents of coal—sulphur, chlorine and phosphorus—when burned on mechanical stokers. Since chlorine and phosphorous compounds in coal are more allied to fouling problems, and with oil coming more into usage, the relationship between corrosion and the sulphur content now requires much more investigation than was at first thought, and must be dealt with more fully.

**592. The Design of an " Everclean Window " for the Observation of the Optical Density of Flue Gas.** Crosse, P.A.E., Lucas, D. H., and Snowsill, W. L. (Jour. of the Inst. of Fuel, November 1961, **34,** 503-505). One of the main causes of unreliability in smoke density meters, the obscuration of the duct windows by smoke, has been overcome by the use of a new type of window the " everclean window ". Two variants of the " everclean window " are described, one for use in positions where the duct pressure is permanently below atmospheric, and one for those positions where the pressure can alternate above and below atmospheric. In general, the windows will require no external supplies and will remain clean for periods longer than a year without attention.

**593. Measurement of Atmospheric Pollution with Aid of Filter Papers.** (In German). Kemeny, E. (" Staub " **21,** 1961, No. 11, 504-506). In Pretoria while using filterpaper devices with changeable air volumes it was found that the relationship E 5/3 = a V exists between extinction (optical density) and air volume. As a result the value E 5/3 per cubic metre is a good measure of the soiling ability of polluted air but this figure has the disadvantage of being not comparable with the units, used in the United States of America. The necessity of standardizing the methods for smoke measurements was underlined.

**594. Study on Electro-Precipitator Performance in Relation to Particle Size Distribution, Level of Collection Efficiency and Power Input.** Heinrich, D. C. (Transactions of the Institution of Chemical Engineers, 1961, **39,** 2). Three major aspects of precipitator performance are investigated; size distribution, level of collection efficiency and power input. It is shown that large-scale test results produce fractional efficiency or migration velocity curves which are at variance with theory. An average curve from practical large-scale tests is taken to calculate the effect of particle size distribution on efficiency and the effect of a higher level of efficiency on migration velocity. Calculated results are compared with full scale plant results. The theoretical basis for the influence of power input is given and compared with test results. Theoretically and in practice, a larger amount of fine particle markedly reduces the average migration velocity. A similar marked effect is predicted when increasing the level of efficiency, but has not been found in practice. Relatively closest agreement between migration velocity and current input is found, next comes h.t. power input. No agreement is shown between migration velocity and h.t. voltage.

**595. The Case for Smoke Control Areas.** Martine, W. R. (Roy. Soc. Hlth. J, April 1962, **82/2,** 103-105). A statistical survey of death from respiratory diseases in Birmingham, and a comparison with areas where there is no atmospheric pollution.

**596. The Effect of Clean Air Legislation on the Ironfounding Industry.** Shaw, F. M. (BCIRA J., March 1962, **10,** 194-202). The principal provisions of legislation governing the emission of sume, smoke, grit and dust as far as they affect iron foundries are outlined. The way in which this legislation is being implemented by local authorities and the Alkali Inspectorate is indicated and some guidance is given on the interpretation placed on " practicable means ". It is pointed out that capital outlay on control equipment must inevitably rise as legal requirements become more stringent and the pressure of public opinion grows.

**597. The Contribution of British Standards to the Control of Air Pollution.** Lay, J. O. (Fuel Econ., 1962, **40,** 81-83; Fuel Abs., March 1962, **3,** 124). The success of legislation governing pollution

of the atmosphere depends to a large extent on the availability of standards and codes of practice on which the necessary action can be based. The Committee on Air Pollution (Beaver Committee) recommended that the British Standards Institution should prepare codes of practice indicating the extent to which smoke can be reduced with good practice and standard specifications for smoke indicators, recorders and alarms. The B.S.I. has not only completed these tasks but undertaken others such as the preparation of standard Ringelmann charts and the measurement of solids emitted from chimneys. A whole range of investigations has also been conducted in the domestic field.

**598. Passenger Car Hydrocarbon Emissions.** Mills, K. D. et al. (SAE Preprint 440A/62, Jan. 1962, 6 pp.; Thornton Res. Cent. Engng. Abs., March 23rd, 1962, 8). The paper presents the results of an investigation of the normal sources of hydrocarbon emissions of passenger cars, *i.e.* crankcase ventilation and exhaust systems, the carburetter, and the fuel tank vent. Five vehicles were used, covering a range of mechanical conditions and different engine and power train configurations. The largest single source of hydrocarbon emissions was found to be the exhaust (60-86 per cent. of total) followed by the crankcase breather. Relatively minor emissions were measured as a result of fuel evaporation from the carburetter and fuel tank during periods of operation and hot soak.

**599. National Air Sampling Network Measurement of $SO_2$ and $NO_2$.** Perry, W. H. and Tabor, E. C. (Arch. Environ. Hlth., March 1962, **4,** 254-264). At present forty five stations are collecting gas and particle samples. This article describes in detail the basic gas sampling unit, the Autoanalyzer unit for sulphur dioxide measurement, nitrogen dioxide measurement, in which a dilute solution of sodium nitrite is produced by pulling air through sodium hydroxide. There is no comparison so far of NASN results with those of other agencies. Details of testing, calibration, limitations are given.

**600. Exhaust Gases from Road Vehicles. An Annotated Bibliography.** Stevenage: Warren Spring Laboratory, 1959, reissued 1962, 37 pp. The abstracts are listed under the sections (1) Methods of reducing pollution (catalysts, afterburners, etc.), (2) Smoke from road vehicles, (3) Composition of exhaust gases, (4) Effects, (5) Analysis, (6) General.

**601. Study of the Removal of Sulphur Dioxide from Waste Gases.** (In German). Wolfermann, L. (Mitt. Inst. Energetik, Lpz., 1961, **34,** 234-244; Fuel Abs., March 1962, **3,** 129). The authors review the present state of technology in respect of the possibility of reducing the sulphur dioxide emitted in waste gases. The methods considered include the reduction of the sulphur content of the fuel, binding the sulphur dioxide during combustion, the use of higher chimneys and the removal of the $SO_2$ from the waste gases. The last method is considered in detail. It involves the absorption of sulphur dioxide by an aqueous suspension of chalk, MgO, ZnO or ammonia. None of the methods is completely satisfactory, and a new method for reducing the sulphur-dioxide content in waste gases must be found.

**602. Removal of Soot from Gases.** (In Polish). Karakowski, J. and Pikon, J. (Przem. chem., 1961, **40,** 398–402). The method is based on diffusion and on condensation of $H_2O$ on the surface of soot particles, causing an increase in weight and agglomeration. The soot concentration is reduced from 500 to 2 mg./cu. m.

**603. Dust Control in the Cement Industry.** Pilpel, N. (Brit. chem. Engng., April 1962, **7,** 258-263). The article describes how dust is formed at various stages in the manufacture of Portland cement and how techniques such as bag filtration, electrostatic precipitation, cyclone separation, etc., are employed to reduce its emission to an acceptable level. Details are given of the cleaning equipment which is in current use in cement works in the United Kingdom and abroad.

**604. Gaseous Pollution from Chimneys.** Scorer, R. S. and Barrett, C. F. (Int. J. Air. Wat. Poll., Jan./Feb. 1962, **6,** 49-63). It is not possible to obtain a formula for the ground-level concentration of pollutant emitted from a tall chimney which is applicable in all conditions; a simple theory is therefore used to derive a table from which long-term average concentrations can be estimated. A treatment of the effect of the plume rise due to buoyancy is included. The limitations of the table are discussed, including the effect of buildings. Particular attention is paid to conditions of light wind, and it is shown how to make a rough estimate of pollu-

tion in a smog. Finally, an idea of the frequency of the various meteorological conditions is given and meteorological control is discussed.

**605. Can Motor Car Exhaust Cause Cancer?** (*New Scientist*, March 22nd, 1962, **13**, 672). Hoffman and Wynder in New York, have shown that the benzene extract from a car exhaust is rich in carcinogens. 60g of tar were recovered from 43h of engine-running, containing twenty-four polynuclear hydrocarbons. The tar extract dissolved in acetone was painted on the backs of mice three times a week for fifteen months. 60 per cent. of the animals produced tumours. This may be relevant to the cause of human lung cancer, but as the carcinogen content in the exhaust tar was 50 to 100 times that in cigarette tar, and as a casual relationship in animals is not necessarily transferable to man, much more work needs to be done.

**606. Some Implications of Ambient Air Quality Standards.** Goldsmith, J. R. (A.M.A. Arch. Environm. Hlth., Feb. 1962, **4**, 151-167). Standards have been set for the following: oxidants, ozone, nitrogen dioxide, hydrocarbons, photochemical aerosols, carcinogens, sulphur dioxide, sulphuric acid, carbon monoxide, lead, ethylene, and particulates. Levels of acceptable pollution, and the effects of exceeding these levels, are examined and discussed.

**607. Profits from Air Pollution Control.** Fraser, D. S. C. (Brit. Chem. Engng. March, 1962, **7**, 190-191). What today are frequently considered " waste gases " from the manufacture or processing of chemicals may well be the source of vast quantities of energy now recoverable through catalytic oxidation. Increased operating profits resulting from utilization of this energy may be the determining factor in the installation of air corrective equipment. This article presents a few of the operations in the manufacture and processing of chemicals where catalytic fume combustion may serve the dual role of profitable energy recovery and air pollution control.

**608. Sanitary Problems, Planning, Construction and Atmospheric Air Pollution in Populated Areas.** (In Russian). Gurinov, B. P. et al. (Uchen. Zap. Moscow, 1960). This information about the problems of planning, construction, and sanitary protection of atmospheric air in populated areas is contained in the Scientific Notes, No. 6, of the F. F. Erisman Scientific Research Institute of Sanitation and Hygiene, and consists of numerous papers by different authors.

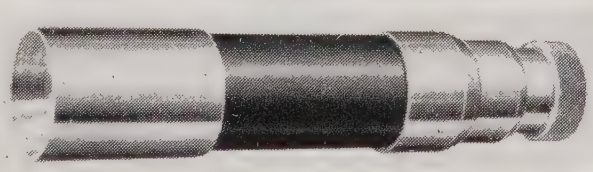
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## Air Jets for Smoke Stacks

Under conditions of low wind velocity the smoke plume emerging from a factory chimney stack may often descend to ground level in the local factory vicinity. Under these conditions the local area will be contaminated with objectionable fumes.

Research work carried out at the National Physical Laboratory has indicated that the smoke plume may be carried clear of the chimney stack by using compressed air-jets. The high-speed jets of air are projected vertically from both sides of the smoke plume from vertical pipes which are selected in accordance with the wind direction. Patent application (No. 23277/59) has been made, the inventor being named as C. H. Burge.

*Check the density of smoke with*
**The "TELESMOKE"**

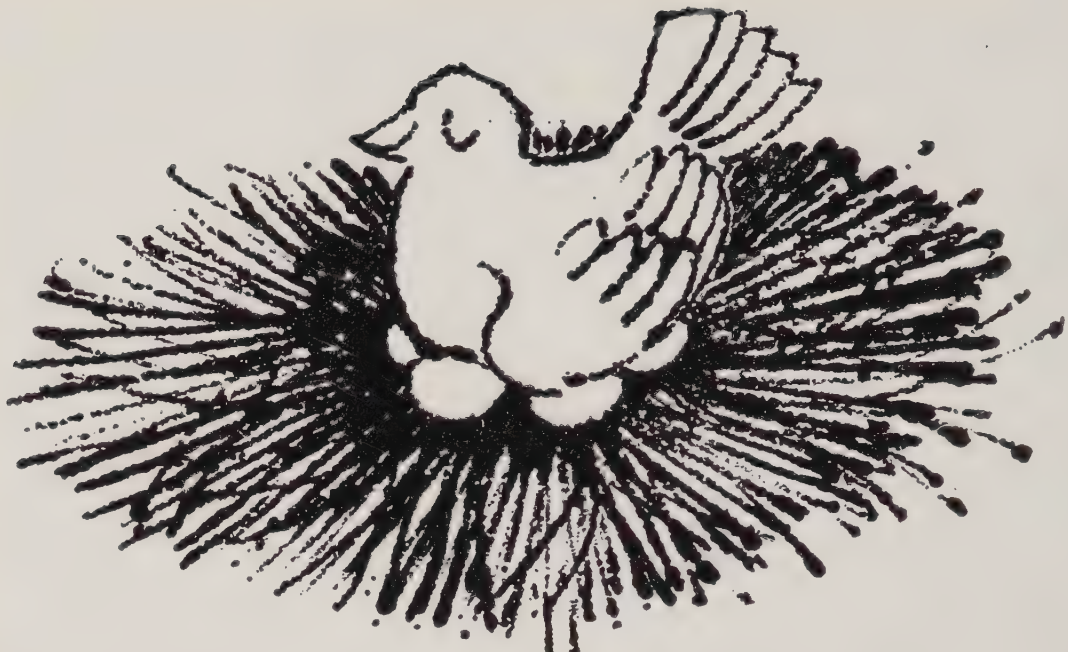


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In fact, electricity cuts out sweeping, and any other kind of dirty work. Electric floor warming, for instance, can provide warmth and comfort in any new building—office, factory or home—for a very moderate running cost. Also, it is cheap to install; electric floor warming obviates the need for fuel stores, chimneys, and (alas for an old and time-honoured profession!) the need for chimney sweeps.

Electric cleanliness is becoming more and more desired and desirable; where new housing is concerned, people choose electric cooking, because it keeps the kitchen clean and new looking. All round—electricity is the modern way. You just plug in and enjoy electric living.

*There'll always be plenty of electricity.* Nuclear energy will see to that. Thank goodness. For electricity promises that we and our children will breathe clean and healthy air.

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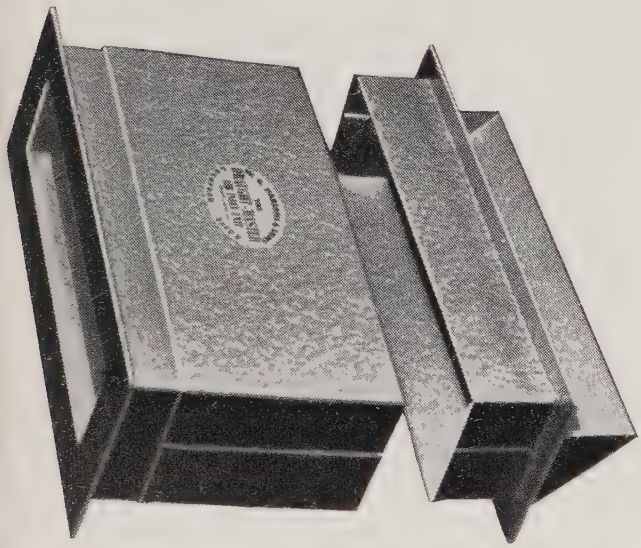
## THE FUTURE IS ELECTRIC

# CONTRIBUTIONS TO CLEANER AIR

## TECHNICAL AND INDUSTRIAL PROGRESS

### Automatic Air Inlet

Designed primarily to overcome air starvation in rooms and flues, the " Draught-Master " automatic warm flow air inlet unit eliminates room draughts but at the same time, allows the fire adequate air to burn efficiently. By cutting out cross room draughts, the room temperature is raised at floor level and in this way, the temperature in the flue is maintained even when it is on an outside wall and the fire is low.



*The Draught-Master automatic air inlet unit*

Inconspicuous, self-regulating and automatic in operation, it is installed close to the ceiling in an internal wall, usually above a doorway. Incoming air gains in temperature by dilution with the warm air in the room, hence the " warm flow " principle.

The one-way inlet of approximately 16 sq. ins. is an air changing diaphragm for the benefit of the flue. It opens immediately the room door is closed and closes automatically when the door is opened, thus preventing the loss of warmed air from the upper part of the room.

It consists of a duct of standard brick size with inlet and outlet sections, spigoted to allow telescopic adjustment to walls of different thicknesses. The inlet section has a hinged cobex one-way flap which is now entirely silent in operation. The outlet section has an extended open throat with deflecting louvre to direct the incoming air to the ceiling. The overall size is 10 in. x 4 in. approx. and the finish is in stove silver hammered enamel on galvanized steel.

The " Draught-Master " has been developed and is manufactured by W. G. Parsons & Sons, heating engineers, of Rochford, Essex.

### Hot Blast Melting Plant

Emissions from cupolas can be classified broadly as dust, smoke, fume and stack gases. The quantities emitted depend on the charge materials used, the design of the furnaces and the chemical reactions in the furnace.

Hot blast cupolas must be registered under the Alkali and Works Regulation Act before operation can commence, and the standards demanded for cleaning of the emissions are higher than those called for under the Clean Air Act for cold blast cupolas.

At the Warwick factory of Thomas Potterton Ltd., the installation is the first of its type in the U.K. and to some extent, therefore, is a pilot installation.



*Exterior of the hot blast melting plant at Warwick, showing the* 100 *ft. stack*

The briefing given by the Alkali Inspector was that the total exhaust gases from the cupola was to be taken through suitable dry dust arrestment apparatus of cyclonic type and then to vent through a stack of height 100 ft. above site level.

The installation finally decided on, and approved by the Alkali Inspector, consists of a cyclone mounted above and between the cupola stacks into which each of the stacks discharges. Above the cyclone is a high temperature exhaust fan which provides the necessary positive suction to ensure the cupola gases are drawn through the system at an adequate velocity and discharge into the chimney stack.

The dust and grit collected in the cyclone are discharged from the base through a rotary valve, finally passing down a delivery pipe to a container at ground level.

Whereas the normal wet type arrester in more common use gives a more rapid and local fall out, the aim of the regulations now is to provide reasonable dust collecting efficiency with high level dispersion of smoke, fume and stack gases.

The whole of the plant was supplied and installed by the Constructional Engineering Company Limited, Titan Works, Charles Henry Street, Birmingham, 12.

### A Smoke Density Telescope

A small, low-power, non-erecting telescope which combines the image of the smoke under test with two density filters in a common plane where they can be viewed and compared through the eyepiece is now available at the offices of the Society for inspection. It is known as the " Telesmoke " and has been developed in conjunction with the Department of Scientific and Industrial Research by W. Ottway and Co. Ltd., Ealing, London, W.13.

The smoke and the filters can be seen under similar conditions of magnification, light intensity and freedom from parallax distortion. It enables a single observer to secure a rapid and accurate assessment of the smoke density.

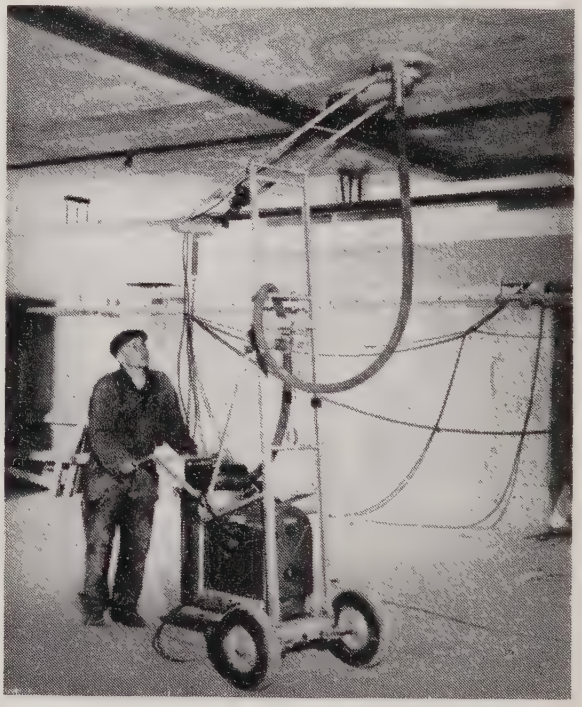
The Telesmoke is pre-set for range focus and can be used at any distance from 50 yards upwards, though the recommended range of approximately 100 yards has been found to be the most satisfactory distance. The two filters cover half of the total field of the instrument, leaving the other half free for viewing the smoke under test. The lighter filter has a density equivalent to No. 2 Ringelmann and the darker one No. 3 Ringelmann. A filter unit equivalent to the No. 2 and No. 4, or No. 3 and No. 4 Ringelmann can be supplied as an alternative.

### Solving the Dust Problem in Plaster Sanding

The Swedish building industry is now using a machine which gives virtually dust-free sand finishing by combining the functions of a sanding machine and a vacuum cleaner.

In Sweden, plaster is sprayed on to walls and ceilings and, when dry, leaves a rough surface which needs finishing by mechanical sanders. Owing to the nature of the material, great quantities of dust are raised when using normal sanding methods, which necessitates the operators wearing special clothing and face masks. The problems caused by this plaster dust being carried in the atmosphere must also be reckoned with.

It was decided to try out methods which would give simultaneous sanding and automatic dust removal by suction and the problem has been effectively overcome by the special machine now evolved. This comprises a British-made portable industrial vacuum cleaner (BVC Model T.16 X) mounted on a special chassis, fitted with movable arms which carry the sanding machine. The latter is fitted with a hood which covers the sanding pad and is connected to the cyclone head of the



*Combination vacuum/sander in use by a Swedish building firm*

vacuum cleaner by means of flexible hose.

Using this machine, the sanding operation can be efficiently controlled and the process can be undertaken as a relatively clean operation.

This is one of numerous specialized uses of vacuumation which BVC consider could be applied to other similar problems without difficulty.

### Climasol Heat Pump

The heat pump has for a long time been recognized as a potentially important means for obtaining heat economically and without air pollution, and we have been interested to receive particulars of the "Climasol" heat pump from the manufacturers, Lucas Industrial Equipment Ltd. (The Radleys, Birmingham 33, and Hargher Clough, Burnley). The brochure describes the principles of the heat pump and the design and performances of the three Climasol models that are available. They all work on the vapour-compression cycle, using refrigerant "Freon 22."

The "31" model is for domestic purposes, and will give a heat output sufficient to provide whole house heating up to 1,200 to 1,500 square feet floor area. A 3 kW. boost heater is incorporated to supplement the heat output at extremely low outside air temperatures. The "32" model is similar, but also provides for air cooling during hot weather, and the "33" model is a commercial air condition for larger premises and incorporating a 6 kW. boost heater.

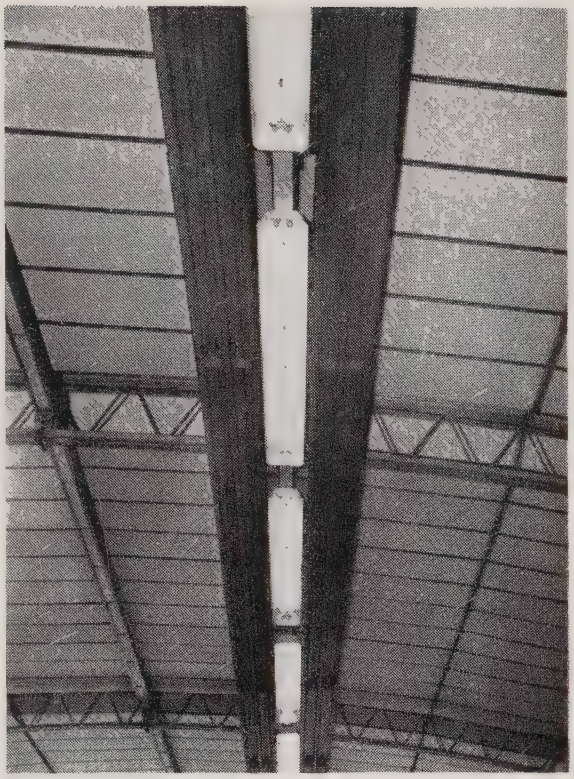
It is claimed that the running costs are a little less than for comparable central heating by oil, and about half the cost for gas or under-floor electric heating.

### Combined Electric Heating and Lighting Unit

Copperad Ltd., and The Benjamin Electric Ltd., have pooled their experience, research and production facilities to produce a unified system of heating and lighting.

"Raylite" is a combined heating and lighting system comprising a double run of Copperad Raystrip continuous radiant strip heating surface between which is mounted a run of Benjamin Taskmaster lighting trunking. To the trunking are fitted tubular fluorescent or other lighting fittings, to give continuous strip or spaced lighting as required in one integrated unit.

Extra independent runs of lighting or heating can be added as required, depending on the heating medium and the desired illumination value.



*The Copperad heating and lighting unit*

The Raystrip heating incorporated in Copperad Benjamin "Raylite" is designed for operation on steam at low and high pressures, and on hot water at temperatures up to 360°F. or more. Heat outputs range from 372 B.T.U's. per hour per foot run on low temperature hot water up to 1,416 B.T.U's. per hour per foot run on steam at 150 p.s.i.g.

### New Ideas in Industrial Cooling

A new type of heat exchanger, 25 times more efficient than the conventional air-cooled exchanger, has been developed at D.S.I.R's. Warren Spring Laboratory. This equipment, which uses an air-water froth as the cooling medium, is one of the developments described in the Laboratory's Report for 1961, reviewed on another page. Its performance is comparable with that of a water-cooled exchanger.

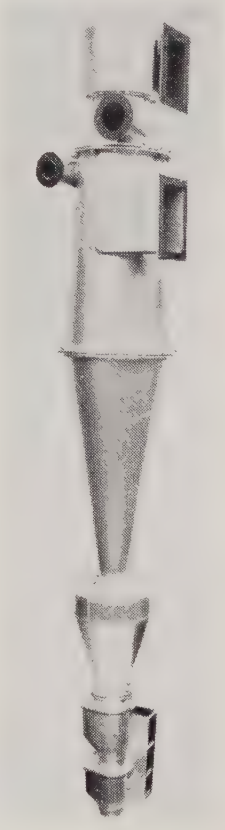
Air cooling has hitherto had the disadvantage of needing a great deal of space owing to the size of the heat-exchangers required. In the froth-contact heat exchanger developed in the Laboratory, tubes containing the material to be cooled are immersed in an air-water froth created

by blowing air through a sieve plate in the bottom of a water tank. Cooling occurs in two stages; in the first the tubes to be cooled are covered by a thin frequently renewed film of water to which heat is transferred at a high rate. In the second stage, the film is carried from the tubes into a constantly-moving froth, where, although the rate of heat-transfer is lower, the area over which heat-transfer occurs is very large. Although the amount of water required is roughly equivalent to that used with cooling towers, the high-powered pumping equipment which forms an important part of the cost of the cooling-tower system is not needed.

### The Collectron

A new type of dust collector, the "Collectron" has been recently developed to produce a high degree of precipitation in a primary cyclone type chamber. The air or gas flow leaving this chamber still carries a certain amount of the finer dust which is extracted by a sleeve into a high velocity re-cycling circuit.

The dust is carried through the re-cycling fan and returned into the primary chamber where it is mixed with the incoming, heavily dust-laden gas, which further assists in precipitating the fine particles. A high degree of collection, comparable to electrostatic precipitators or fabric filters, is obtained.



Collectron units maintain a high collecting efficiency through the whole range of particle sizes even down to two microns. Single units capable of handling up to 4,000 cu. ft. of air or gas per minute, with very high grain loadings, are in production. Collecting efficiencies in excess of 99 per cent have been achieved with carbon black particle sizes mainly below one micron, using two 12-inch units in series and operating at a temperature of 600°F.

Further information may be obtained from Collectron Ltd., 32 Aylmer Road, Leytonstone, London, E.11.

### Reducing Coke-Oven Smoke

How to pour 15 tons of crushed coal into a red-hot oven at a temperature of 1,340°C. without causing smoke? Faced with this problem, the National Coal Board's carbonizing engineers have been working for two years to find a solution.

They have now succeeded at the East Midland's Avenue coking and chemical plant, in collaboration with the Woodhall-Duckham Construction Co. Ltd. The company has perfected a new type of coal charging car and the prototype is in operation on the top of the oven batteries. The East Midlands Division of the N.C.B. has decided to spend £14,000 on replacing the plant's second charging car.

The operation of feeding the raw coal into an oven formerly involved the use of all four charging holes at the same time, the coal being fed by gravity from four hoppers on the car. The new car, fitted with hydraulic controls, itself lifts and replaces the oven lids. Each hopper discharges its coal in a sequence designed to keep the smoke and gas generated during the operation within the oven battery and by-products system.

A source of air pollution has thus been eliminated, conditions have been improved for men working on the battery top and there is a marginal effect on the gas and by-products yield, because less of the coal's content goes to waste.

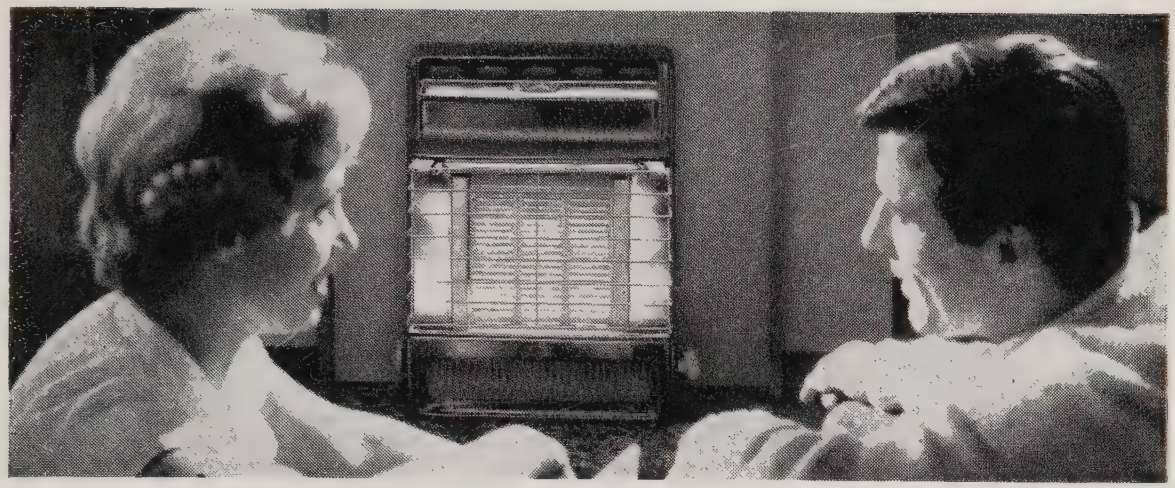
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### Chlorine Detector

A monitor which is able to detect one part per million of chlorine in the air is soon to be marketed in Great Britain. Within 20 seconds of detecting presence of chlorine, the monitor operates an alarm bell.

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The Royal Navy was asked to co-operate in the investigation of a dust nuisance recently which affected the Burrfield's area of Portsmouth. They were asked to permit the use of Admiralty equipment for checking the size of dust particles.



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## solves dust problems *Everywhere!*



**6 special features**

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- Capital costs as low as 3/6d per cu. ft. of air handled
- No risk of "blow-backs"
- Less than half the space required by cyclone and filter bag installations
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- Suitable for high temperature gases

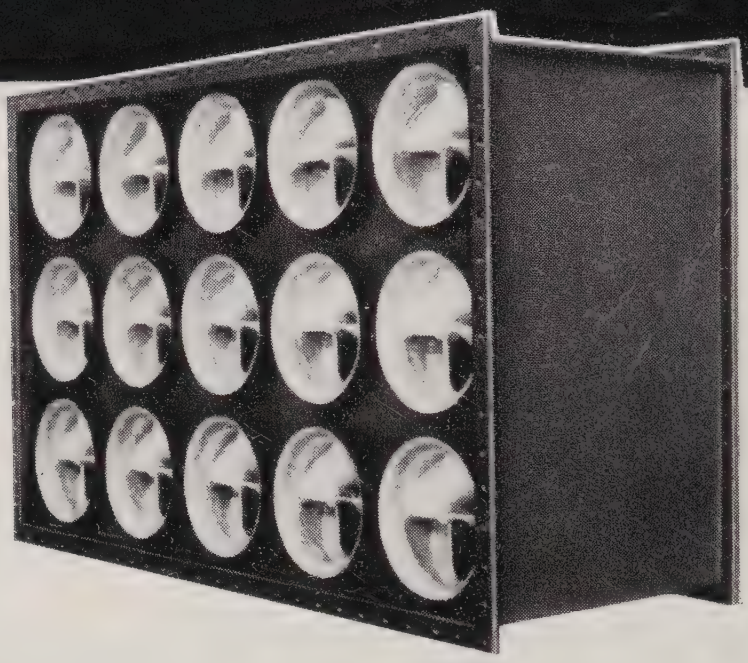
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# SIROCCO
## "R" Type
# DUST COLLECTORS



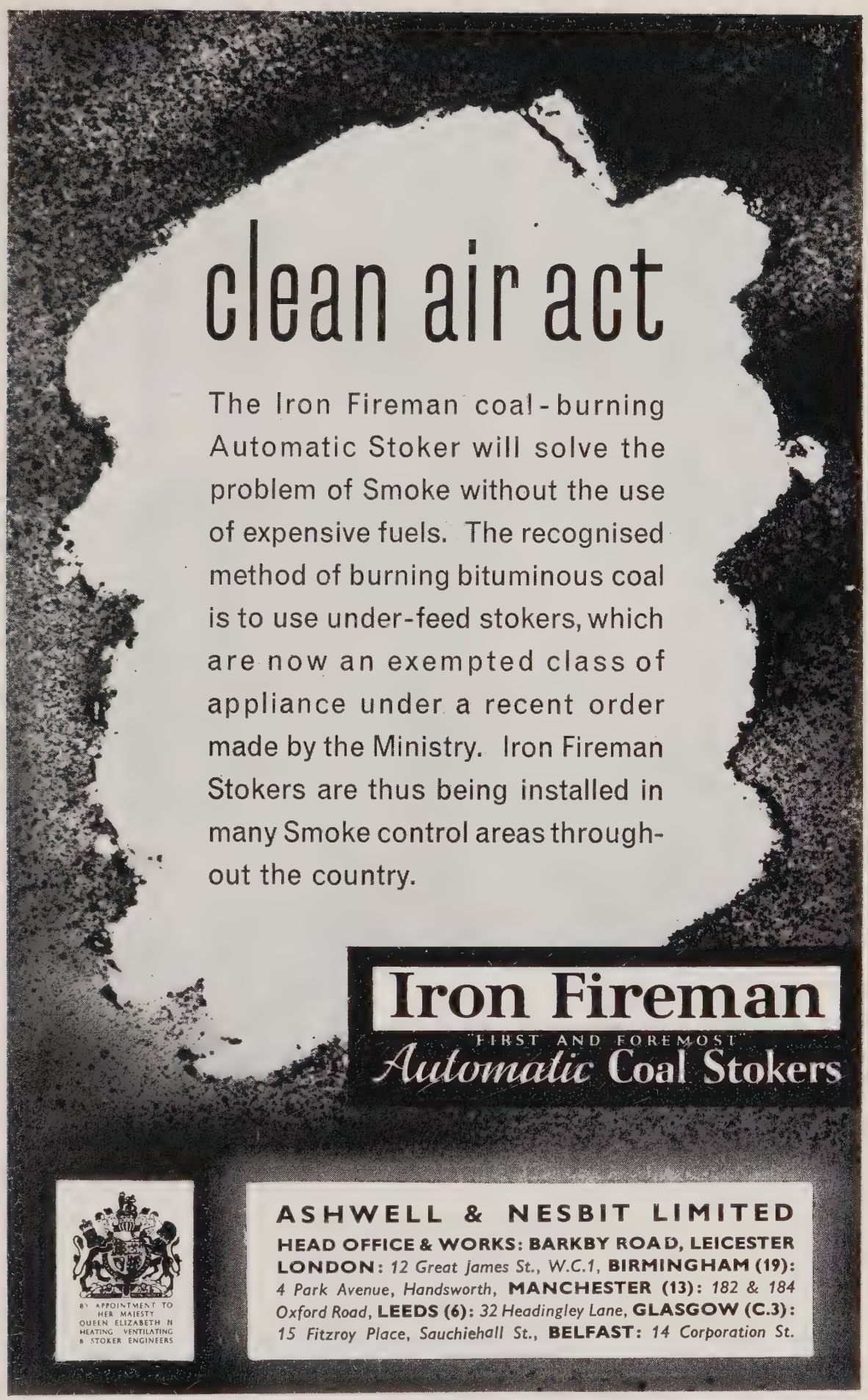
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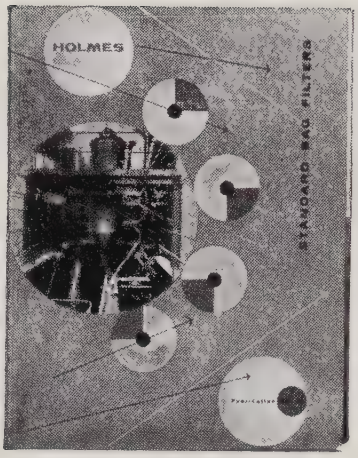
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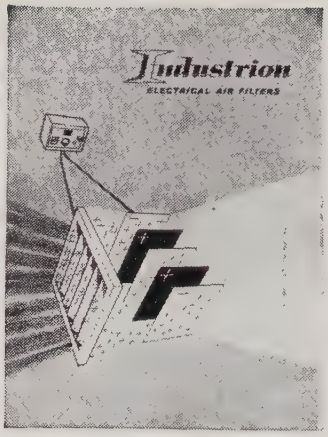
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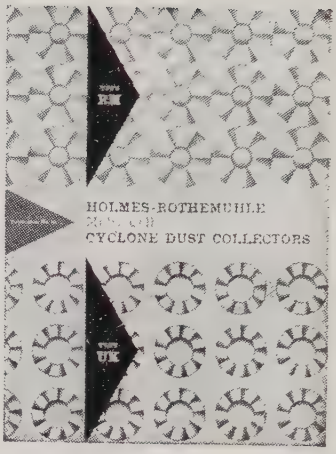
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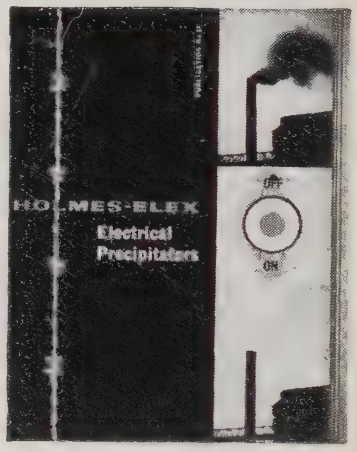

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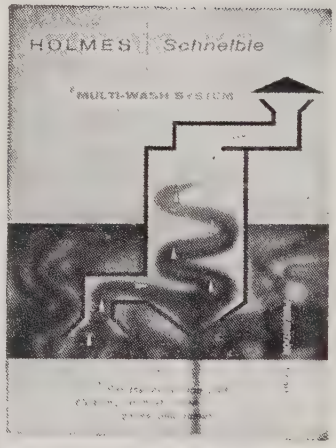




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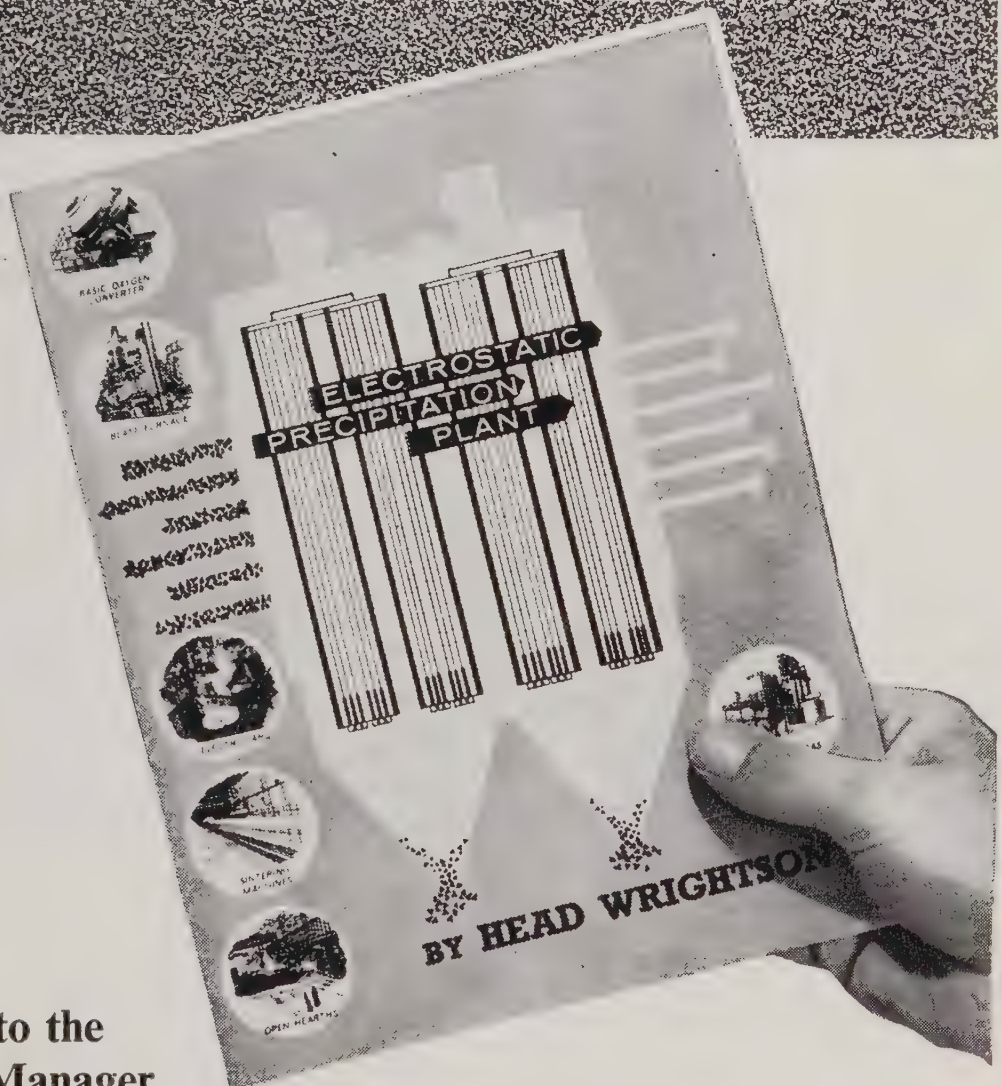
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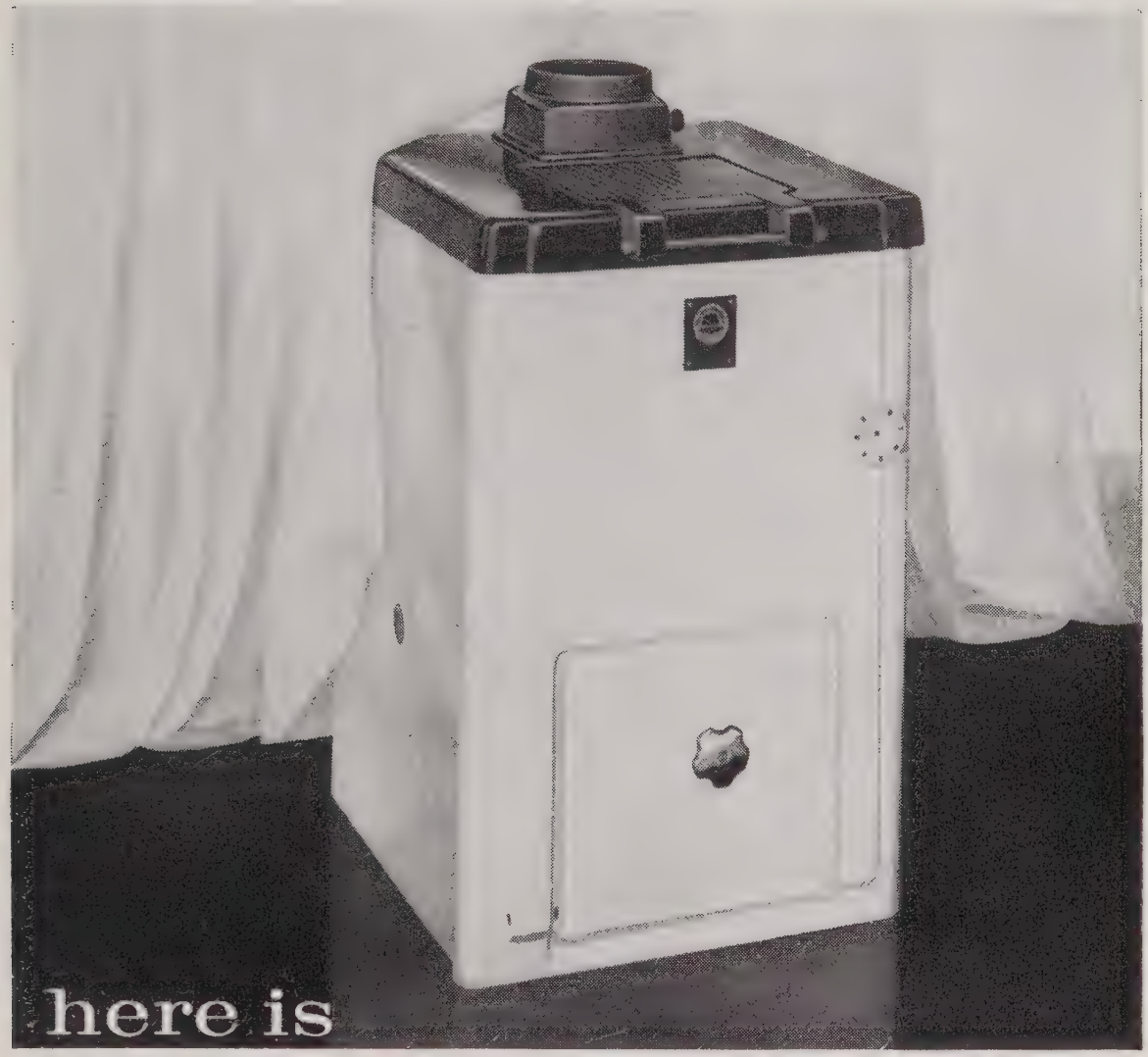
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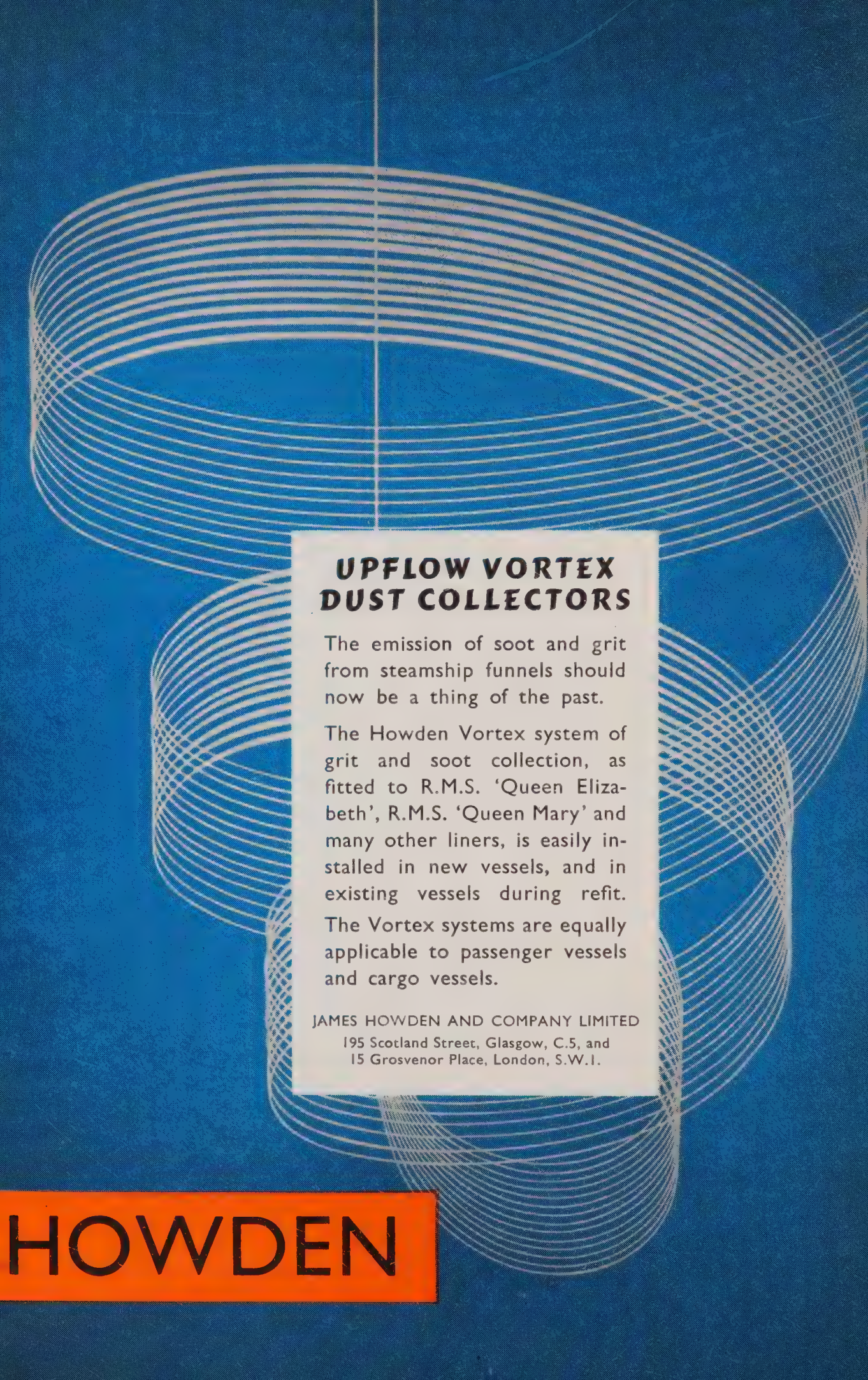

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